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MECHANICS' MAGAZINE,

MUSEUM,

Register, Journal,

AND

GAZETTE,

APRIL 5, 1834—SEPTEMBER 27, 1834.

VOL. XXI.

" ———— to none refused
Are Wisdom's precious gifts as heretofore
When clerks their knowledge selfishly misused;
All may the tracks of science now explore:
Perish the vain monopoly of lore!
The gloom-dispelling radiance of the morn
Delighteth not the rising traveller more,
Than it doth glad my heart, that lofty scorn
Recoils from the repellant strength of wisdom lowly born."

CHANDOS LEIGH.

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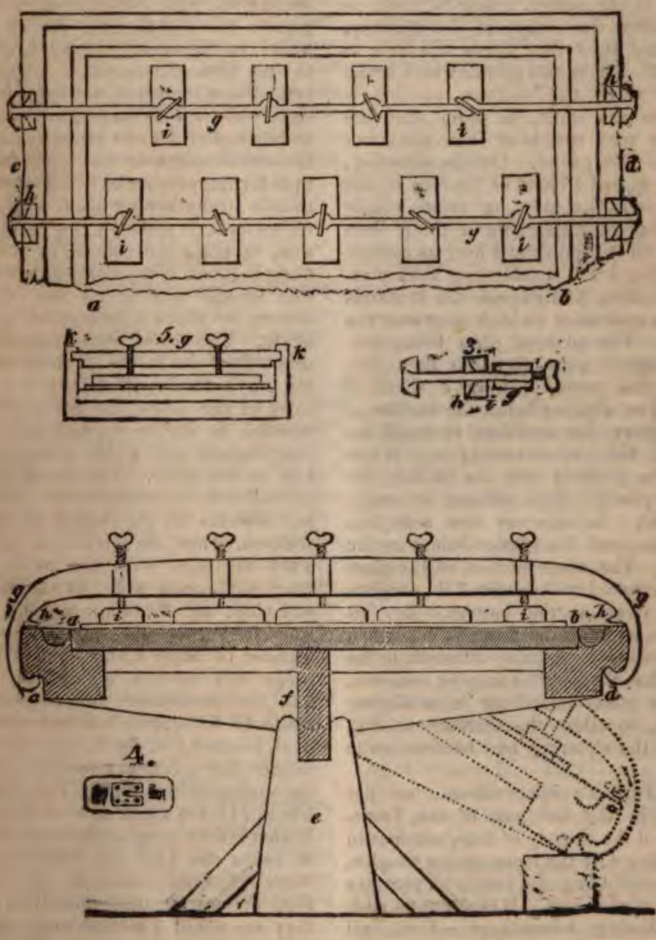
FARROW'S GLASS SILVERING MACHINE.



FARROW'S MACHINE FOR SILVERING LOOKING-GLASSES.

The large silver medal and five pounds have been presented, by the Society of Arts, to Mr. George Farrow, of Silver-street, Golden-square, for a machine of his invention for silvering looking-glasses. The common silvering-table for looking-glasses, is a slab of stone, ground to the most perfect degree of evenness, and placed in a frame, so that a certain degree of obliquity can be given to it. All round the margin is a gutter, through which, at one corner, a hole is made, so as to allow the escape of the mercury, when the plug that closes the hole is removed. It is this corner which is the lowest, when the oblique position is given to the table, in order that the mercury may run to it from the other parts of the gutter. On the silvering-table is spread a sheet of tin-foil, of the same size as the glass, or rather a little larger; a fluid amalgam of tin is then poured on it, and spread over its surface with a brush till it adheres; more mercury is then poured on, till it stands about a quarter of an inch deep over the tin-foil. The plate of glass being previously made quite clean, is then slid, gently and steadily, from a sheet of paper, just dipping below the surface of the mercury, but avoiding to touch the tin foil, for fear of tearing it. When the glass is fairly over the tin foil, the table is placed a little oblique, by means of a rack; the mercury now runs into the gutter, and the glass subsides on the tin foil. The whole surface of the glass is then covered with leaden 7 lb. weights, having cloth at the bottom. By this pressure, at the end of twenty-four hours, the silvering is so firmly adherent to the glass, that the weights may be removed, and the glass raised up in a sloping position, to allow the mercury to drip off, till the silvering has become quite hard.

Mr. Farrow's improvement, as described in the last part of the Transactions of the Society of Arts, consists in dispensing with the loose leaden weights, and in producing the required pressure by means of screws. It is attended with the following advantages:—First, all hazard of breaking the glass during the application of the pressure is avoided; when loose weights are used one will sometimes slip out of the hand of the workmen, and, falling on the glass, will break it. Secondly, the plate, as soon as the pressure is made by means of the screws, can be tilted up, even in a vertical position, so as to expedite considerably the drip of the mercury from the silvering; an operation which is manifestly impossible when loose weights are employed. Mr. Farrow himself has hitherto applied his invention only to small plates for dressing table-glasses; but Mr. Wheeler, a manufacturer of looking-glasses, has applied Mr. Farrow's apparatus, with some modifications to plates, 48 inches long by 29 inches wide. In the accompanying figures, 1 is the top view of one end of a large stone bed; 2 is a section of the same; *a b* the stone slab; *c d* its frame, containing the usual channel for the mercury; *e* one of the end supports, on which the bed may turn for the purpose of being tilted; the middle strengthening bar *f*, which serves for an axis, is placed a very little on one side, to make the side *d*, at which the slope is given, always preponderate, that side usually resting on one or more screws, by which it is lowered or raised again. The dotted lines in fig. 2, show that side of the bed as lowered, and resting on a block. The upper and under sides of the frame *c d* are made quite parallel to fit the hooked ends of the long clamps *g g*, which slide from one end to the other. The clamps are furnished with little plates *h h*; these project inwards for the clamps to stand or slide on, when the screws are loosened. They are also, with the under hooks, made sufficiently wide, as shown in the end view, fig. 3, to prevent the clamps from falling on one side. A sufficient number of these clamps is provided to range over the bed, about 1 foot apart; and the screw-holes in one clamp are made to be opposite the intervals in the next, as shown in fig. 1, in order to distribute the pressure more equally over the surface of the glass. The clamping-blocks *i i i*, are made of wood faced with leather—they hang on the screws loosely, so as to rise and fall with them, and allow of being placed in any position. Fig. 4, one of these blocks separate; they are about 7 inches long, and the screws are eight inches apart. The clamps are usually all drawn to one end of the bed to be out of the way, and to make room for the glass plates being

slid on, and need only be taken off when the largest glass is to be silvered, and then replaced to give the pressure. Fig. 5 is an end view, or elevation, of a portable bed, for silvering small glasses, and is Mr. Farrow's original invention; it has wooden sides *k k* raised above the bed, in which the several wooden clamping-bars *g g* slide. Here two screws only are used to each bar; and the battens that hang on their lower ends are in one piece. This, with the glass on it, is placed by hand in any required position. The glasses being quite clean for silvering, the faces of the battens, or clamping-blocks, *i i i*, never take any dirt whilst in use; and as they always remain pendant, with their faces downwards, when out of use, they keep clean, so that the glasses are not liable to any scratches from them.

HYDRAULIC PROJECTOR.

Sir,—I will neither occupy your valuable columns, waste my own time, nor insult the understandings of your readers, by refuting, in detail, the arguments adduced by Mr. Witty in this day's Mechanics' Magazine, in support of his watery project; his letter is a singular compound of truth and error, not easily unravelled, or briefly answered. He has admitted the important fact, that he has not yet constructed the machine described in your 544th Number; when he has done this, and finds its performances equal his expectation, it will be high time for him to explain to N. C. (vol. xx. page 301) "the cause of such extraordinary results."

Mr. Witty says, "the action of the mechanism your correspondents do not find fault with:" truly, the mechanism may be much improved upon, but a fig for such improvements in a machine founded on false principles.

I have no doubt that when Mr. Witty can get the water to be so obliging, as to jump twenty feet high from a conical fifteen-inch tube, plenty of contrivances will be forthcoming to give due effect to so much condescension.

Mr. Witty wishes to know the extent of my last visit to Newcastle, with particulars of my experiments. When there, lately, I had the full use of all my senses, common sense included, but I never stated that I made any experiments! This is another of Mr. Witty's fancies.

Whenever Mr. Witty constructs a machine like the one he has described, and obtains the result he calculates, I guess he will have proved the existence of such a pretty considerable difference between the laws of gravity, motion, and atmospheric pressure, in this latitude and in Staffordshire, that I shall feel it incumbent on me to proceed thither directly, and institute suitable experiments to establish the novel and marvellous peculiarities of this (*then*) wonderful county.

When this comes to pass, you shall hear more about the matter, from,

Yours respectfully,

WM. BADDELEY.

London, March 29, 1834.

SAXTON'S DIFFERENTIAL PULLEY, AND ITS APPLICATION TO LOCOMOTIVE PURPOSES.

Sir,—Having visited the experimental railway laid down near Gloucester-gate, Regent's-park, for the purpose of exemplifying Mr. Saxton's plan for propelling vehicles on a rail-road, by means of what he calls his "locomotive differential pulley," and heard the lecture thereon by his friend Mr. Hawkins; but being far from satisfied with the results of my observations on the occasion, I determined to inquire further into the subject. I therefore constructed a model to answer that purpose, and am now prepared to demonstrate that Mr. Saxton's plan can never be made to realize the expectations formed of it.

But, before doing so, it may be as well to give your readers some account of this differential pulley; which I cannot do better—more fairly, at least, to the inventor—than by quoting the description of it which Mr. Hawkins read to the Society of Civil Engineers, and which was afterwards published in the *Repertory of Arts*:—

"I beg leave," says Mr. Hawkins, "to premise (what is familiar to every engineer and mechanician) that any radius of a wheel or pulley may be considered as a simple lever.

"This investigation may be pursued under three cases.

"*Case* 1st.—Let the lower perpendicular radius of a vertical wheel of 40 inches

diameter, resting on a horizontal plane, be considered as a lever 20 inches long; see fig. 1, where *a* represents the horizontal plane, *b* the wheel, *c* the lower radius or lever.

Fig. 1.

"Let the lowest end of the radius where it meets the plane, be the fulcrum of the lever, and let a thread be fastened to the lever at 2 inches above the fulcrum, as shown in fig. 2, where *a b* is the plane, *c d* the lever, *c* the fulcrum, *e f* the thread. If that thread be pulled horizontally the distance of 1 inch, it is obvious that the top of the lever will be moved in the same direction the distance of 10 inches, as shown by the dotted lines.

"Now, let the top of the lever represent the axis of a wheel or pulley of 20 inches radius, and the pulley itself in rotation on the plane be considered as a continued succession of such simple levers, with fulcra progressing at the same rate, it will be evident that if a thread be fastened to, and wound around a pulley of 18 inches radius, then the common axis will move forward 10 inches for every inch motion of the thread; and the progressing fulcra, forming the periphery of the wheel, will keep pace with and remain perpendicularly under the axis, the velocity of which to the speed of the thread, being as the radius of the wheel is to the difference of the two radii; in this case 10 to 1.

"*Case 2d.*—Let the thread, mentioned in case 1st, be held fast so as to constitute it a fulcrum of the lever at two inches above

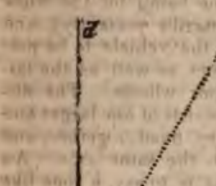


Fig. 3.

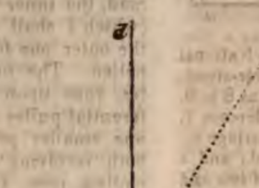


Fig 4.

the plane; and let another thread *c g*, fig. 3, be fastened to the bottom end of the lever and pulled in an opposite direction, the distance of 1 inch, the result will be, that the top of the lever will be moved in a direction opposite to the pull, the distance of 9 inches, because the leverage will in this case be as 9 to 1; the dotted lines show the position to which it would be pulled.

"*Case 3d.*—Let both threads be pulled in opposite directions at the same time, and each drawn the distance of half an inch, then the top of the lever will be moved in the direction of the upper thread, the distance of 19 half inches, or 9½ inches, being as the sum of the two radii to their difference; and the common fulcrum will be at a point equidistant, and at a right line between the points of traction of the two threads; see fig. 4.

"Now let the threads be fastened to and pass round the peripheries of two concentric pulleys united together, of 18 and 20 inches radii respectively, the threads being pulled in opposite directions, will cause the common axis of the pulleys to proceed in the same direction as the pull of the upper string, with a velocity of 19 times the speed of the threads; being like the simple levers befors shown, as the sum of the two radii is to their difference.

"But if, instead of two threads being fastened to the pulleys, and endless thread be made to pass around two riggers at the ends

of the path of the pulleys, one side of which endless thread takes a single turn round one of the pulleys, and the other side of the thread a single turn around the other pulley, the endless thread being turned by one of the riggers, or by a power applied in any other manner, will draw the pulleys with the same proportional velocity, in the direction of the thread passing around the smaller pulley; see fig. 5, where *a* is the endless thread, *b* the riggers, *c* the pulleys, *d* the lower radius, *e* the continuing place of the fulcrum of the leverage.

Fig. 5.

"In Mr. Saxton's model at the National Gallery of Practical Science, Adelaide-street, West Strand, the pulleys are about as 8 to 9, consequently the sum 17 to the difference 1, expresses the real velocity of the carriage relative to that of the drawing cord; and a horse at his most effective speed of two and a half miles per hour, attached to an endless rope passing round pulleys in those proportions, would draw a carriage attached to the common axis at the rate of 42½ miles per hour."

Now taking Mr. Saxton's elevation (or that of Mr. Hawkins'), viz., that of Shooter's-hill, which is assumed to be the highest at which any rail-road would be of practical utility, and which rises in the ratio of one in eight, I find, by calculation and experiment, that it requires twelve times the power of propulsion at that acclivity, that would suffice upon level ground.

Whatever it is—be it what it may—that a single horse-power can propel upon a level rail-road, the same weight would require twenty-five horse-power to propel upon Mr. Saxton's plan. Now, it is obvious that, if this be the fact, it would require twelve times twenty-five, or 300 horse-power, to propel any given weight at the above elevation. In order to be distinctly understood upon this point, I will re-state it in other words:—What one horse will perform upon a level rail-road, 300 horses will be required to do upon a plane at the elevation of Shooter's-hill, on Mr. Saxton's plan. How, it may be asked is this immense power to be attained, or, if attained, at what cost? Could any benefit result from it? In my opinion there could not. It follows, then, upon an ascent equal to that of Shooter's-hill, the "locomotive differential pulley" loses all its supposed virtue, and becomes worse than abortive: for, be it remembered, that Mr. Saxton's plan is chiefly recommended upon the ground that it will supersede the necessity of cutting through hills.

It is my object to show, that Mr. Saxton's plan is founded in ignorance of the principles of mechanics. The interest, as well as the honour, of science renders this exposition necessary; but I have no personal feeling whatever in the question.

My model represents a double railroad, the inner one being for the truck (which I shall describe presently), and the outer one for the vehicle to be propelled. The former, as well as the latter, runs upon four wheels. The differential pulley consists of one larger and one smaller pulley fixed together, and both revolving on the same axis. An endless rope, that is to say, a rope like a lathe-band, having no termination, passes over the larger pulley of the truck, and thence runs to its destination, viz., the point at which the truck stops; at that point it passes over a fixed pulley; after which, returning, it passes over the second, or smaller pulley of the truck; and, finally, again revolves over the first fixed pulley from which the truck commences its progress. To the rope we have been describing is attached a branch rope, which is fastened to a horse that draws the truck, in the same manner as barges are drawn on the banks of canals. Mr. Saxton proposes that the horse shall go three miles an hour—the vehicle to be propelled in that time thirty miles.

The vehicle to be propelled is placed over the truck, which has a balance-catch in front; this catch strikes against a bar fixed to the vehicle, and the force

of the concussion propels the latter forward. The operation here described is repeated, from point to point, by means of successive trucks stationed at fixed distances from each other, along the whole line of road to be traversed.

In my model the weight of the vehicle to be propelled is twenty-three ounces and a half, loaded with one hundred and twelve ounces, which make the whole weight equal to one hundred and thirty-five ounces and a half. This, on a common level rail-road, is propelled by two ounces. Now, by fixing my model in proportion to the elevation of Shooter's-hill, I find it requires twenty-four ounces to propel the above weight at that ascent. But, according to Mr. Saxton's plan, the weight of the truck is to be taken into account, viz., twelve ounces, making the total one hundred and forty-seven ounces and a half; and this additional weight renders it necessary to have a power of fifty ounces to be able to propel both truck and vehicle on a common level rail-road. Multiply 50 by 12, and it gives 600 ounces to propel the truck and vehicle at the elevation of Shooter's-hill. In other words, it would take 600 horses to perform, at that elevation, the work of two upon a common level rail-road. In less elevations the power required will, of course, be in proportion. It is, therefore, manifest that the "locomotive differential pulley" can never be made to answer the expectations of the inventor and patrons of the scheme.

But the fundamental objection to the principle of Mr. Saxton's invention is the immense friction it creates; the whole action consists of nothing but friction; whereas every mechanic knows, or ought to know, that the great object should be to diminish friction. The only effect produced, in point of fact, is friction; and, in this respect, the invention reminds me of what Mr. Bramah once denominated a "friction machine."

Having trespassed at so much length upon your valuable time, I will only, in conclusion, observe, that I have no wish to exalt myself by depreciating the abilities of others, or to decry any invention calculated to be beneficial to the community; but, in the present instance, being convinced of the futility of the scheme in question, and that it is utterly impracticable for any useful purposes, I think it a duty to disabuse the minds of those who have fancied they have discovered in it the germ of some new and splendid improvement.

I am, Sir, &c.,

W. J. Adams.

Nassau-street, Middlesex Hospital,
March 22, 1834.

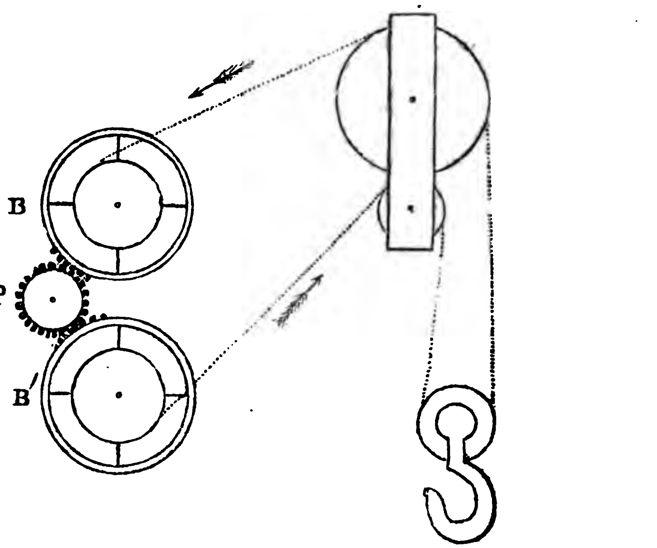
IMPORTANT DISCOVERY IN MAGNETO-ELECTRICITY—DIFFERENTIAL CRANE.

Sir,—Since my last communication I have been engrossed by a course of electro-magnetic and magneto-electric experiments, which have, I am happy to say, ended in a discovery which arms the inquirer into magneto-electricity with power scarcely dreamt of. The details of the discovery, and of the leading and collateral experiments, I have sent, as matter purely scientific, to Professor Jameson's *Edinburgh Philosophical Journal*, in the April Number, of which they will, if not too late, appear. Should they not so appear, I shall have great pleasure in communicating to you some of the leading particulars; as I am sure many of your readers are interested in the subject, and would feel farther delay a grievance. I may here state so much as that, instead of moving either armature or magnet in developing the magneto-electricity, I keep both stationary; that the motion is confined to a separate auxiliary piece of apparatus to be called a galvanic reverser; that the armature and magnet are of one solid piece, forming together a new instrument, to be called the magneto-electric ring; and, lastly, that the power and capability of enlargement possessed by the apparatus, seem to have scarcely any limit. I can hardly state more at present, without encroaching on matter sent to another journal; and I could scarce do even so much, had not a friend, in whose favour I was keeping the secret, given me to understand that he cannot immediately follow up what I had communicated to him on the subject. I beg to add here, as it may be of use at some future time to have done so, that the first idea was conceived on the 25th of January last, the leading experiments made on the 29th of the same month, and that the first magneto-electric ring, with its auxiliary the galvanic reverser, was completed, and proved to answer even beyond expectation, on the 22d of Feb. last.

In the mean time, Sir, as I find an accumulation of matter more strictly mechanical in my note-book, I shall take the liberty to extract two or three things from it, in the hope that you may deem them worthy of being transferred to your pages.

* * * * *†

The next figure represents a plan for applying the differential principle to cranes. I find it noticed in my note-book, under date 11th July, 1832. Your brief notice of Mr. Saxton's differential-pulley, in the last month's Part of the Mech. Mag., recalled it to my recollection. I suppose the principle is the same, and I extract it not only to furnish an additional example of the coincidence of different and independent thinkers in the same train of discovery, but also as a hint worthy, perhaps, of adoption in practice. The coincidence I have alluded to has ceased to surprise me, since I have reflected upon the general uniformity of the structure of the human mind, the limited number and the simplicity of the original models nature places before us, the slight diversity of the materials we have to work upon, and the sameness of the wants and necessities which serve to stimulate to exertion.



In the fig. B and B′ are two barrels for winding the chain of the crane upon; they are each furnished with toothed wheels, but that of B has one tooth less than the wheel of B′. Since then B takes in the chain, and B′ gives it out, the weight will be raised by the differential power resulting. P is the pinion of the winch.

After all this is merely a more convenient form of the old invention, which is quoted as a standing example in every treatise on mechanics, and in which the barrel worked by the winch is divided into two sections, slightly differing in diameter; the rope being also so fixed on, that it is taken in by the part of the larger diameter, and given out by the other.

I remain, Sir,

Your obedient servant,

φ. μ.

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* We pass over (to be inserted at some future opportunity), descriptions of an universal tool for cutting outside screws—a plan for uniting the thermometric and pyrometric scales—a fisherman's lamp to burn under water—and an improvement in canal locks—all distinguished by our esteemed correspondent's usual ingenuity, in order that we may find room this week for the account which follows of a plan for applying the differential principle to cranes, which the author thinks will be probably found similar in principle to Mr. Saxton's locomotive-pulley, which happens to be described, for the first time, in our present Number.—Ed. M. M.

EFFECT OF COMBINATIONS ON THE INTRODUCTION AND IMPROVEMENT OF MACHINERY.*

As hostility to machinery is a very prevalent feeling among the working classes, it might be supposed that they would turn all the power of their Unions towards its suppression. In this attempt, however, they have been singularly unsuccessful; and so far have they been from attaining, or even approaching the attainment of this object, that their efforts have led to an exactly contrary result, and some of the most valuable and ingenious machines that our manufactories can boast of, actually owe their existence to the operation of Trades' Unions.

The cotton trade affords one remarkable instance of the truth of this observation. The evils inflicted on this manufacture by strikes have been detailed; many years ago, the masters with the view of escaping these disastrous effects of the tyranny of the Spinners' Union, requested the machine-makers to attempt the construction of a self-acting mule, that is, of a mule, which should perform its work without the assistance of a spinner. For a long time the attempt was regarded as hopeless, difficulties stood in the way, which it is not easy to describe, requiring, however, all the resources of mechanical genius to surmount. But the successive efforts of mechanists have by degrees overcome every obstacle, and the skill of Mr. Roberts, an eminent machine-maker at Manchester, has brought the invention to perfection. The most extraordinary power of this machine, consists in its manner of regulating the motion of the spindles, when the mule is receding to its frame; during this retrograde course, which carries the mule over the space of 4½ feet, about three times a minute, the velocity of the spindles is constantly changing, and this continues as many hours as they are filling with thread; they exhibit, to speak mathematically, a *fluxion* of movement; during no two successive portions of time, however small, is the speed the same. The machine may now be seen in action in several mills, and almost appears to realise the finest results, that could be expected from human ingenuity.

The following evidence taken by the Committee of Manufactures and Commerce, which sat last Session, will show the way in which the combination of the spinners is forcing the adoption of this machine. It is given by Mr. Graham, a Scotch manufacturer:—

"We are paying much higher in Glasgow than they are paying in England for spinning the same numbers, and in consequence of this, we have been driven to employ machines, which may supersede those men (spinners).

"Are you aware of any cotton-spinning work, where the proprietors are turning out the old machinery in consequence of the combination of the workmen, and introducing self-acting mules?—We are doing it ourselves.

"Have you adopted the self-acting mule to get rid of combinations?—Before adopting the self acting mule, I had the plans drawn, and I called a deputation from the men in, and explained it to them, and I said, 'You drive us either to take machines, or you drive us to bankruptcy, or to stop our works; here is an order going off to Manchester for self-acting mules; we do not wish to introduce them, and we will be the last house to introduce them, if you will take the same wages that they have in Lancashire;' and they said, 'It is no use, we are determined not to reduce our wages.'"

The introduction of this invention will eventually give a death-blow to the Spinners' Union, the members of which will have to thank themselves alone, for the creation of this destined agent of their extinction. It is now rapidly coming into use; other advantages, besides the great one of escape from the dictation of the workmen, are found to attend it; and in a few years the very name of working-spinner, as well as the follies and oppression of their combination, will only be found in history.

The turn-out of the Lancashire workmen in the building-trade, has introduced a curious application of the steam-engine. This machine is now employed in some towns, instead of manual labour, in hoisting the various building-materials to the top of the edifice, where they are intended to be used. The magnificent design of the Liverpool custom house is at the present moment rising into existence by the assistance of steam. The following letter from a master-builder, who was one of the principal sufferers in this strike, graphically describes the circumstances attending the introduction of the improvement:—

"Sir,—I have much pleasure in complying with your request, and shall feel happy if any information, which I can afford, will be useful to your purpose. About two years ago, the bricklayers' labourers, whom I had

* From a very interesting pamphlet just published by Messrs. Ridgway, entitled, "Character, Object, and Effects of Trade Unions," written for the purpose of demonstrating the injurious tendency of these Unions, and written, it must be confessed, with great ability; but which, it is only fair to add, contains many facts of very questionable authenticity, and calls for new laws to put down a class of associations, which, if all be true that the author asserts of them, may be safely left to work out their own downfall.

at work at the new custom-house here, began to exhibit symptoms of rebellion, the building being unusually large, and requiring much work. I found that, just in proportion as we were hurried, the labourers began to relax and grow careless, and sometimes did not do a sufficient quantity of work to cover their own wages. My wits were accordingly set to work to discover a remedy. I well knew that if I resorted to severe measures, a general strike would have been the consequence; but as we had on the ground, about 35 yards from the front of the edifice, a 7-horse steam-engine for the purpose of mixing up our lime and sand into mortar and making grout, I had the shaft of the mill lengthened, and a drum fixed upon it; attached to this was a chain governed by a break, which we carried in a hollow trough under ground, and connected with a cross-beam placed upon two uprights on the top of the building. We then placed 300 bricks in a square box, slung it, and tried our engine. The bricks went up in fine style, and were received at the top by waggons placed on a light railway, furnished with cross-slides, and the result was that two labourers could fill the boxes with bricks below, sling them on the chain, and two more receive them at the top, who, by the help of the railway conveyed them (weighing 23 cwt.) to any part of the building with ease. We thus rendered useless the services of about 20 hod-carriers at once, at the cost of about 100*l.* in machinery. The remainder of the men were for a long period quiet, and would have continued so, had not the Trades' Unions virtually compelled them to strike, many of them against their wills. The contrivance just mentioned has acted so well, that, when in full work, we usually send to the top of the building 16,000 bricks per diem, with 7 or 8 tons of mortar and grout, the engine all the while doing its other accustomed work. This would only pay in large buildings; in small erections the expense of fixing the machinery would be too great; but small high-pressure steam-engines are now made, which stand upon 3 feet square, consume about 1 cwt. of coal a-day, and will hoist with sufficient rapidity 25 cwt. to any height, they are also sufficiently portable to be moved about in small carts; or I am satisfied that a horse with a rope and pulley, working through a snatch-block, would be cheaper and better than the old system of manual labour.

"The contractor for the stone-work at the new custom-house raises all his materials by a small engine (I think it is 8-horse power), which cost him 150*l.*, and his other additional machinery about 200*l.* more. He sends his stones (varying from 1 to 11 tons in weight) up to the summit with perfect ease. His engine like ours is stationary, and his ropes run round the building to that part where the work is proceeding, and though they are sometimes 500 feet in length, no difficulty is experienced from this cause. We send up indiscriminately, bricks, stone, iron, or timber; the engine is much more tractable and civil than the hod-men, easier managed, keeps good hours, drinks no whiskey, and is never tired. I need hardly add that in a large building it is much cheaper, more expeditious and satisfactory, than carrying up materials on men's shoulders. The time consumed by the men in *descending*, and by the slowness of their ascent consequent on the loss of strength caused by having to overcome the gravity of their own bodies, before they have strength to spare for carrying a heavy burden, makes the hod-carriers far inferior to the steam-engine, more especially if we consider the constancy with which the latter works. I do not now fear a turn-out of hod-carriers, because I have proved that we can do very well without them, and I think that I now see many other modes of saving labour, which I should instantly avail myself of, were another strike to happen amongst my workmen. It is also obvious to myself that many of the uses to which machinery is now applied, may be traced to turn-outs, which, having subjected masters to inconveniences, have compelled them to scheme mechanical contrivances, that otherwise would not have been thought of. Feeling that improvements in mechanism will not eventually injure the labourer, yet I would not hastily adopt such, as would suddenly deprive a number of men of their subsistence, did not their own folly compel me to it. I am now quite sure that another strike or two will annihilate many hod-carriers, and brick-makers, and this principle of hoisting by stationary or moveable steam-engines, will, no doubt, be adopted for many other purposes, if the operatives in particular departments endeavour to force their employers to pay a higher rate of wages than they can afford. For instance, we know that two stationary engines at each dock, with shafts and drums running along the quays, would discharge the cargoes of all the ships, with a tenth of the porters now employed; at present I should be sorry to see it adopted, but I know before long it must be done.

"I am, Sir,
"Your very faithful servant,
"SAMUEL HOLME."

"Liverpool, Feb. 7, 1834."

The machine lately introduced in the wool-combing business has also been alluded to; the history of its invention gives, in a short compass, a view of the process by

which results of this kind are brought about. The Woolcombers' Union has been celebrated above a century, and several Acts of Parliament have been passed with the object of suppressing the power which it had acquired, and exercised with the usual bad consequences. Hence, many endeavours have been made to comb wool entirely by machinery, but with very partial success, till last year, when the whole of the combers in a large factory struck, upon which the proprietors turned their attention to this machine, applied their skill and capital to its improvement, and in a short time brought it to such perfection, as completely to supersede the employment of wool-combers.* It consists of two large wheels, set with spikes, and which are made to approach and recede alternately from each other; the spokes, fellies, and axles are all hollow, by means of which steam is kept constantly flowing through every part of the machine, like the arteries in the human body, diffusing the required warmth to every corner of the engine. This invention is now daily coming into wider use; it performs its work both better and cheaper than by the old process, and before no long period has elapsed, the trade of wool-comber, like that of cotton-spinner, will cease to exist.

Mr. Babbage, in his "Economy of Manufactures," has given two other instances of invention of modes for superseding human labour, owing to strikes among workmen; one occurred in the manufacture of gun-barrels, and the other in that of iron tubes in general; and, doubtless, many other cases might be found, in which a similar process had taken place.

The obvious result of this forced and premature adoption of new machinery, is to displace labour with inconvenient rapidity; and, instead of improvement proceeding by those gently varying gradations, which characterise its natural progress, it advances, as it were, *per saltum*, and comes upon the workman unprepared for the change, which his course of life must subsequently undergo. The counter effect in retarding the improvement of machinery, sometimes caused by combinations, is so trivial, as hardly deserve mention. But whatever power they may have in this way, the end of it must be to increase still further the evil just alluded to, and to make the progress in the application of substitutes for labour more fluctuating and irregular. At one time they are unnaturally held back, at another pushed forward.

It would be a glaring absurdity to suppose that the improvement of machinery can be really hurtful to society, or lessen the demand for labour in the country which employs it, when we have the example of Manchester before us, where, within a radius of forty miles, more human beings are collected together, and substitutes for labour more extensively used, than on any other spot on earth, and where, in addition, wages are for the most part enormously high. It undoubtedly is productive of transient injury by the displacement, which it causes of manual labour in those operations to which it is applied. But this evil is trivial, if the displacement be slow, and is formidable only when it is pushed on, as in the cases above mentioned, with sudden violence.

We might view these inventions with unmixed pleasure, on account of their use to society, and even—considering the force of example—without much regret for the retribution they inflict on the offenders, were it possible to put out of sight some of the evils which may for a season follow their introduction. The community certainly gains by such mechanical improvements, which, since they spring from hostility to combinations, may be considered an indirect effect of them, and form, as far as we are aware, the only benefits those bodies have bestowed upon their country, in return for the violence and oppressions of which they have been guilty.

EXTRAORDINARY SHOWER OF FIERY METEORS.

On the morning of the 13th of Nov. last, one of the most extraordinary showers of fiery meteors that, probably, ever was witnessed, took place in America. It appears to have been visible all over the United States, the newspapers and journals of which have ever since teemed with accounts of the phenomenon. We extract the following very picturesque description, from the *American Journal of Science*:—

"Missouri, Lat. 30° 26′ N., Long. 91° W.

"On Wednesday morning, 13th Nov., we were awakened by a friend, and told that the stars were falling from the heavens, and flying about in all directions. We instantly hurried from our room, and found, to our

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* Till within a few years of the time when this machine was introduced, it could not have been made, though it might have been imagined, and every part and principle necessary to its construction clearly and accurately described. The reason is, that the skill and nicety of execution necessary to the manufacturing of such a machine, or of any machine requiring delicate adjustments, did not exist. The principle of Bramah's press was known two centuries before its application, but was a barren truth, till mechanism had advanced sufficiently to give it an existence.—See *Babbage on the Decline of Science.*

utter astonishment, that although not so in reality, the wonderful appearances in the heavens warranted the assertion. This place is situated on an elevated point of an extensive prairie, and presents an unbroken view of the horizon, and thus afforded us an excellent opportunity of observing the phenomenon; but language fails to convey an idea of the extraordinary and appalling scene. Above us, and all round the firmament, as far as the eye could reach, more numerous than the stars themselves, which were this night uncommonly bright—we beheld innumerable fireballs, of a whitish pallid colour, rushing down, and, to all appearance, crossing the sky in all directions—drawing after them long luminous traces, which clothed the whole heavens in awful majesty, and gave to the earth a lurid and death-like aspect. Our first look, after a hasty and general glance, was directed to the zenith, and at that instant an inconceivable number of meteors, or falling stars, as though the sky had just received a mighty shock, burst from the blue and cloudless arch, and shot, like so many burning arrows, toward every part of the horizon. We next turned our eyes to the west, and here they appeared to be flying in that direction; but we soon found that that was the case to whatever quarter of the heavens we directed our view.

"Though there was no moon when we first beheld them, their brilliancy was so great that we could at times read common-sized print without much difficulty, and the light which they afforded was much whiter than that of the moon in the clearest and coldest night, when the ground was covered with snow. The air itself, the face of the earth, so far as we could behold it, all the surrounding objects, and the very countenances of men wore a death-like hue, occasioned by the continued pallid glare of these countless meteors, which, in all their grandeur, 'flashed lawless through the sky.' There was a grand, peculiar, indescribable gloom on all around. There was scarcely a spot in the firmament that was not filled every moment with these meteors; and the long luminous traces which they left behind, like the train of some mighty rocket, would last for several seconds; and, at times, when the nucleus had entirely vanished, these streams of light, apparently from 50 to 100 yards long, would linger in the sky, and continue to shine in all their brilliancy for two or three minutes, and then expire in the twinkling of an eye. Their size was apparently as large as the disc of Jupiter—their velocity much greater than that of the common meteors—and from the place of their starting, to where they expired was from 10° to 40°. Occasionally one would seem to burst into flames, and burn with great energy. The meteors vanished from sight without any audible explosion, and frequently without scintillations. One of the observers described a meteor seen at three o'clock as being far more brilliant than any of the others, appearing as large as the moon, and shedding a glowing light, which, for a few seconds, rendered even small objects visible."

POETICAL TRIBUTES TO MRS. SOMERVILLE.

(From the last Number of the Quarterly Review.)

I.

Lady! it was the wont, in earlier time,
When some fair volume, from a valued pen,
Long-looked for, came at last, that grateful men
Hailed its forthcoming in complacent lays;
As if the Muse would gladly haste to praise
That which her mother, Memory, long should keep
Among her treasures. Shall such custom sleep
With us, who feel too slight the common phrase
For our pleased thoughts of you, when thus we find
That dark to you seems bright, perplexed seems plain—
Seen in the depth of a pellucid mind,
Full of clear thought—free from the ill and vain
That cloud our inward light! An honoured name
Be yours, and peace of heart grow with your growing fame.

II.

(An Imitation.)

Three women, in three different ages born,
Greece, Italy, and England, did adorn;
Rare as poetic minds of master flights,
Three only rose to science' loftiest heights.
The first* a brutal crowd in pieces tore—
Envious of fame, bewildered at her lore;
The next,† through tints of darkening shadow passed,
Lost in the azure sisterhood‡ at last;
Equal to these, the third, and happier far—
Cheerful though wise, though learned popular—
Liked by the many, valued by the few,
Instructs the world—yet dubbed by none a Blue.

CUFF'S IMPROVED MODE OF CONSTRUCTING AND CLEANSING COMMON SEWERS.

We described, in our 12th volume, page 60, a very important improvement in common sewers, which had been invented by Mr. Joseph Cuff, and adopted, in two or three cases, with great advantage.

The plan having been brought under the notice of the Commissioners of Sewers for the City of London, they referred it to their surveyor, Mr. Acton, who made a report upon it, from which the following is an extract:—

"The utility of stench-traps in small drains, which convey little more than foul

* Hypatia of Alexandria.
† Madame Agnesi of Bologna.
‡ Alluding to the monastery of Blue Nuns, where she ended her days.

water, is very great, but I apprehend their application to sewers would be highly detrimental; for, if but partially used, that effluvium, which is now dispersed by about 800 apertures, would, if forced through fewer vents, become not only from them, but from the drains in the houses, intolerably powerful. Necessarily this would cause them to be attached to every gulley-hole; and if they should be attached to every gulley-hole and every private drain, and the sewers be thereby made air-tight, tubes of various and very irregular diameters, and in many cases with closed ends, I much fear that explosive gas would be so commonly generated, that it would be impracticable to enter them but at an imminent risk of immediate death to the workmen, and injury to the adjoining buildings. That this may not be deemed a chimerical idea, I beg to remind the Court, that when part of the Bishopsgate-street sewer was stopped, men were sent in to cleanse it, and were severely burnt by the ignition of the foul air; and that when the sewer in Tower street was built, and the grates not being in readiness, the apertures were closely covered with boards and earth, some gas having accidently entered the sewer, two men were so seriously injured that the Court had to remunerate them for their loss of time, the destruction of their clothing, and for the expenses of medical aid. Even if no danger of this description could rationally be feared, I apprehend that the traps would, in many situations, present so much obstruction to the passage of water during the heavy rains, as to cause them to flood the houses, and subject the Commissioners to endless claims for compensation. Carefully considering the whole question, I cannot but think the disadvantages attending their use would be found so great that I could not recommend their adoption."

The Commissioners of Sewers, acting on this Report, came to the resolution—"that it is not expedient to adopt this plan within the city."

Mr. Cuff afterwards sought the opinion of Dr. Birkbeck, Mr. Pereira, and other scientific gentlemen, on the validity of Mr. Acton's objections to his plan, and the answers which he has obtained seem to dispose of these objections in a most satisfactory and unanswerable manner. We need but quote, in opposition to Mr. Acton's Report, the following passage from that of Dr. Birkbeck:—

"Upon the supposition of every entrance being thus constructed, which ought, of course, to be the case, the gases evolved must be confined in the principal sewer, and must gradually expel all the atmospheric air; ultimately occupying the whole space: they must afterwards unavoidably begin to escape at the only aperture which is left, the discharging extremity of the sewer. The whole quantity of gas produced must, however, be much less than at present, because of the frequent removal of the great mass of decomposing matter from the gulley-holes, where alone upon this plan it would be allowed to accumulate. When, in the course of six or seven years, it might be requisite to enter the sewer for the purpose of cleansing it, no lamp or candle, it would soon be found, would burn; no explosion could take place; and no human being could respire. This will appear sufficiently obvious, when it is recollected that the whole cavity has long been filled by carbonic acid gas, carburetted hydrogen gas, sulphuretted hydrogen gas, &c., and that the air of the atmosphere has by their disengagement been totally excluded. It would, therefore, be necessary to allow these unrespirable gases to escape by suitable openings or tubes, at the highest points of the sewers; when their place would be occupied by the air of the atmosphere, gradually entering at the lowest extremity, and finally filling the entire cavity: there would then be no difficulty in remaining in the sewer as regards respiration, and very little as regards explosion; none at all, indeed, if the scavengers were furnished with the wire-gauze covering for their lights, as recommended by the late Sir Humphrey Davy. In order to prevent the effluent gas, when issuing thus abundantly, becoming offensive to the persons residing in the neighbourhood, it may be set on fire at the different orifices; and as it would explode when it begins to issue mixed with a certain portion of atmospherical air (that portion which gradually finds its way into the sewer, and escapes with the latter portions of gas), it would be requisite to place in the discharging tubes two or three pieces of wire gauze of suitable fineness, through which the explosive mixture must pass, in the manner well-known by chemists to prove so effectual, in the otherwise dangerous application of the oxy-hydrogen blow-pipe. From what has been already stated, it will appear obvious, that the objections urged by Mr. Acton resolve themselves entirely into—imperfect introduction of the valuable plan of Mr. Cuff—imperfect or defective cleansing of the gulley-holes—and ignorance of the nature, distribution, and management of those gases, which he fears 'would be *commonly* generated;' but which, in fact, are *constantly* generated, and which, on that account, effectually exclude the atmospheric air; with-

out an admixture of which they cannot be, what he terms them, 'explosive.' "

The Commissioners of Sewers, however, still continue opposed to the general adoption of the plan; but they have so far departed from their original resolution of entire rejection, as to announce that, "if any individual complains of the state of the sewers, and requests Mr. Cuff's plan to be adopted, the request shall be complied with." Several individuals have accordingly availed themselves of this permission, to have stench-traps, on Mr. Cuff's plan, attached to the gulley-holes of their premises,—among others, Mr. Deputy Gorst and Mr. Deputy Farrance. In the Tower Hamlets' district, where the pavement trusts are not under the control of the Commissioners of Sewers, the plan is coming into general use.

STATE OF THE ARTS AND SCIENCES IN PERSIA.

Mr. Fraser, the intelligent author of "Travels in Khorassan," and "Tour through the Himala," but, perhaps, better known to general readers for his admirable tale of Khorassan, called "The Kusilbash," has contributed to the "Edinburgh Cabinet Library" a very excellent "Historical and Descriptive Account of Persia."* It is not very well arranged, and in some parts brevity has been studied (to order, most likely) at the expense of clearness; but taken altogether it is the most authentic and accurate account of the Persian empire in the English language. We subjoin an extract from the portion devoted to the state of the arts and sciences:—

"Among the sciences most cultivated are those of astronomy, judicial astrology, metaphysics, logic, mathematics, and physic. In the first their efforts are contemptible; their theories, founded on the Ptolomæan system, with strange additions of their own, are utterly useless, unless it be to aid their still more childish dreams in astrology. No Persian will undertake the most trivial affair, far less any enterprise of moment, without consulting a professor of this delusive art; and when a mirza or a mollah has once established his reputation as an astrologer, he is in the sure way to become rich. Should a lucky day arrive before a traveller is ready for his journey, he leaves home, though he should remain for weeks in some incommodious lodging till his preparations are complete; satisfied that the favourable influence of the stars has been secured by making the move at the proper conjuncture. An ambassador about to proceed to India was induced by the representations of the Wise Men, although the ship in which he was to sail was not ready, not only to leave a comfortable dwelling at Bushire, and occupy a tent on the hot sands near it, but even to cause the wall of the town and several houses to be penetrated, that he might depart without facing a most malignant, though invisible constellation, which would otherwise have blasted the success of his mission.

"Their metaphysics and logic are scarcely less puerile. The first consists of little more than a collection of disputations, sophisms, turning on wild and unprofitable paradoxes; the second, in an ingenious method of playing upon words, the object not being so much to arrive at truth, as to display quickness of mind and readiness of answer in the discussion of plausible hypotheses. Geography is no better understood. Their knowledge of countries and their relative positions is extremely confused; nor can they lay down with any exactness even those places or regions with which they are most familiar.

"Mathematics, although they are not much more beneficially applied, are taught on better principles; for the Persians are acquainted with the works of Euclid. Chemistry is unknown; but alchymy is a favourite study, and the search after the philosopher's stone continues an eager pursuit. The adepts work with no less secresy and hope than their deluded brethren used to do in the West; nor are the frauds they commit on credulous and wealthy dupes less palpable or notorious.

"In their knowledge of medicine they are still deplorably deficient. They declare themselves pupils of Galen and Hippocrates (called by them Jalenoos and Bocrat); but their practice is a mixture of the most wretched empiricism, with the exhibition of a few simples, the qualities of which experience has taught them. They classify diseases into four divisions,—hot, cold, moist, and dry,—and this in the most arbitrary

* "An Historical and Descriptive Account of Persia, from the latest ages to the present time. With a detailed view of its resources, government, population, natural history, and the character of its inhabitants, particularly of the wandering tribes. Including a description of Afghanistan and Belochistan." By James B. Fraser, Esq. Illustrated by a map and thirteen engravings, by Jackson. Oliver and Boyd. 1834.

manner, on no apparent principle. They combat each disease by an application of an opposite tendency,* the virtues of the remedy being as vaguely determined as the nature of the disorder. They are totally ignorant of anatomy, and unacquainted with the circulation of the blood; so that their proficiency in surgery is no greater than their knowledge in medicine; and when patients recover under their hands, it is to be attributed to soundness of constitution, rather than to any ability of treatment on the part of the professional attendant.

"Though they admire the skill of Europeans, they adhere obstinately to their own practice; and all the persuasion of the medical gentlemen who accompanied the British embassies, from the year 1800 to 1810, were insufficient to establish vaccination, although the ravages of the small-pox are often dreadful. In cases where calomel would, in the opinion of the English physicians, have saved many lives, they persevered in resisting its use, as a remedy which, being hot in itself, could not be advisable in a hot disease; ice and refrigerating draughts were given in preference, which cooled many effectually. Yet they have discovered a method of quickly affecting the system with mercury, by causing the patient to inhale, through the common calleeoon or water-pipe, a lozenge made of cinnabar and flour.

"There are persons, among the tribes particularly, who pretend to hereditary powers of curing certain distempers. Sir John Malcolm mentions a chief named Hedayut Kouli Khan, who banished agues by tying his patients up by the heels when the periodical attack was approaching, applying the bastinado severely, and abusing them bitterly all the time,—a process which, he asserted, produced 'heat and terror, instead of a cold fit.'

"The profits of science are confined to those who enjoy a name for high proficiency in divinity, astrology, and physic; but the latter is miserably paid. The two former, when combined, thrive best.

"In the fine arts the Persians have little to boast of; but there is reason to believe that in former ages their skill was much superior to what it is at present. Nor is it to be wondered that excellence in any department should be rare, when the professor runs the risk of being ordered to labour without payment for the king or governor to whom his acquirements might first become known. In painting and sculpture it is next to impossible they should ever become adepts, as, in the first place, they possess no models to imitate, and, in the second, it is repugnant to the Mahommedan faith to make representations of the human form. When we do meet with any such attempt, as in the delineations of battles or hunting-pieces, the total absence of all knowledge of drawing and perspective renders the effect ludicrous, if not disgusting. Ink-stands and small boxes are made at Shiraz and Ispahan, and adorned with painting, chiefly of birds and flowers, and occasionally of beautiful girls and boys, finished with an accuracy which, under better direction, might be successfully exerted for nobler purposes. The stone and seal cutters of the same city are famous for the excellence of their workmanship. Cashan is known for its manufacture of lacquered tiles, which ornament many of the gorgeous domes and minarets in Persia. Coarse china and glass are made in various places. The sword-blades of Herat, Mushed, and Shiraz are highly esteemed, as well as their other work in steel; and gold and silver brocade, with silks of considerable beauty, are produced in many parts of the country."

The "engravings by Jackson" (in wood) are extremely beautiful; we have seen few things equal to them in this branch of art.

* A gentleman in India, whose servant was unwell, consulted a native physician. "Sir," said the doctor, "the patient's illness arises from *sixteen different causes*; now, in this pill which I mean to give there are *sixteen different ingredients*, so arranged that each will operate upon its respective cause, and thus cure your servant."

On Animal Instinct. A Lecture delivered before the Members of the Mechanics' Institute at Colchester. By the Rev. ALGERNON WELLS. Fenton, Colchester. 1834. 40 pp. 8vo.

Philosophical, eloquent, interesting, and instructive. The author's opinion is, that—

"Consciousness, animal sensation, capability of feeling, implies voluntary active power, and that voluntary active power implies mind—is an attribute of mind, and can be possessed and employed only by mind; and that, therefore, that power or faculty by which the inferior creatures are guided in their various voluntary actions, and which we call *instinct*, is nothing mechanical, is no attribute of matter in any way, but is a species of intelligence with which minds is in brutes endowed, and in the use of which they are active, voluntary agents—an intelligence which we can explain in its appearances, relations, and results; but the nature of which, or the manner in which it is possessed by animals, we can no moree xplain

than we can the essences and modes of being in other instances. It is as much, but no more than other works of God, a mystery to us. So far as into other subjects we can dive into this, but no farther. So far as they are plain, this is plain also. Where mystery begins with them it commences with this—and that is, when we abandon facts and relations, and endeavour to explore essences and modes of being."

OLIVER AND BOYD'S CATECHISMS OF ELEMENTARY KNOWLEDGE.*

Those Catechisms in this collection, of which it falls within our province to speak, are extremely well drawn up; simple, perspicuous, and attractive. Mr. Lee, the mathematical master of the Scottish Military and Naval Academy, has done great justice to the different departments of "Natural Philosophy;" and Mr. Wm. Rhind to the "Natural History of the Earth, Zoology, and Botany." "Drawing and Perspective," by Mr. Lawrence, would have been the better of a leaf or two out of Mr. Jopling's "Practice of Isometrical Perspective;" though perhaps the best thing the publishers could do, would be to get Mr. Jopling to furnish them with a separate Catechism on that important branch of perspective.

The Architectural Director. By JOHN BILLINGTON, Architect. Second Edition, greatly enlarged. Illustrated by nearly 100 plates and tables. Part I. Bennet. 1834.

A new edition of a work of standard reputation on the Theory and Practice of Architecture. It is very handsomely got up, and very cheap.

NOTES AND NOTICES.

Steam-Carriage Shares.—The holders are waiting anxiously the expected appearance of the carriage (which carriage?), and few are in the market. They may, however, be quoted steady—Heaton's at 45, Church's 30.—*Birmingham Advertiser*, March 29.

The following is an extract from a private letter from Birmingham:—"I dare say you have heard of Dr. Church's *no-go motive* carriage having been tried, and through the carelessness (so reported to me by one of the parties) of the men, the bottom of the kettle was burnt out." Can any of our correspondents furnish us with the particulars of this trial, and the real cause of failure?

Russell's Steam-Carriage.—A new steam-carriage (Mr. Russell's) commenced plying between Glasgow and Paisley on Wednesday. The carriage is attended by a supplementary vehicle, containing the necessary supply of charcoal and water. The carriage itself is superbly fitted up, holds six inside and twenty outside passengers, and is hung upon springs, quite free of the boiler and machinery. The boiler is extremely small, and occupies the space immediately below the carriage, while the boot contains the engines. The boiler is capable of generating steam in twenty minutes. The two engines, fourteen horse power each, situated above the hind axle, are connected with it, by cranks working at right angles to one another, so as to produce continuous rotary motion. They are contained in a polished brass box of six cubic feet, and communicate with the boiler in a manner imperceptible to the eye, highly ingenious and quite novel. The whole machinery is poised upon curviform springs of the fourth order, so marvellously adjusted as to prevent any concussion or shock from telling, or taking effect upon the engine; while the potential detachment of the wheel from the axle enables the engineer to stop either wheel at will, and so to turn and steer the carriage according to the most tortuous sinuosities of the road. The hind-axle is alone propelled, and the fore-axle is used as a helm whereby to guide the movements of the vehicle. Hence the wheels, both in the front and back, are at the entire command and control of the superintendent; and although the velocity can be extended up to fifteen miles per hour, it can be governed, regulated, and directed with as much ease as our present mails, and adapted alike to an open country or a crowded street.—*Weekly Dispatch*, March 30.

Roberts' Locomotive Carriage.—Mr. Roberts, of the firm of Sharp, Roberts, and Co., engineers, of Manchester, has been for some time engaged in the construction of a locomotive carriage for common roads, for which he has obtained a patent. One experimental trip was made in December, which, while it led to the detection of a few imperfections in the details, easily removed, has tended to establish the soundness of the principle on which the carriage is constructed. On Thursday the second of these experimental trips was made. The carriage started from the works in Falkner-street at half-past six in the evening, under the guidance of Mr. Roberts, with upwards of forty passengers. It proceeded about a mile and a half up Oxford-road, namely, to near the end of Nelson-street, where, owing to an apprehension of a deficiency of water, a sudden turn was made. The breadth of the road at this point was insufficient to allow of free scope for the engine, and about six minutes were occupied in making the turn. The carriage then proceeded back to the works, where it arrived without accident just nineteen minutes after starting. The maximum speed on a level was twenty miles per hour, and the acclivities of the road were mounted without the least sensible effect on the speed. No doubt exists of the engine being speedily put in complete and effective condition for actual service.—*Manchester Advertiser*, March 29.

A nice little World.—The diameter of Pallas does not much exceed seventy-nine miles, so that an inhabitant of that planet, in one of our steam-carriages, might go round his world in a few hours.—*Mrs. Somerville.*

There was a grand exhibition of the Thames Tunnel last week to a number of members of the

* "Elucidating the more simple Principles of Literature, Science, and the Arts. Neatly printed in 18mo.; with appropriate embellishments by eminent artists." Oliver and Boyd, 1834.

Royal Society, and distinguished foreigners, "for the purpose," say the newspapers, "of inspecting this extraordinary undertaking, and of considering the practicability of the completion of the work," when every body present was perfectly satisfied that it could be completed with ease, and that it is a prodigious "reproach to the country," the funds necessary for the purpose are not forthcoming. A "reproach to the country," forsooth! We wonder whether it was explained to the distinguished foreigners who were present, that the country came forward with every farthing of the money which the engineer calculated to be requisite for the complete execution of the Tunnel; and that the total loss from the irruptions of the river, to which the stoppage of the work, *about half-way* is so conveniently ascribed, did not exceed 13,000*l*. The undertaking is at a stand, simply because it cannot be completed for double the engineer's original estimate, and because, if completed at such a cost, it would not, in all probability, yield a shilling of revenue to the proprietors.

Navigation of the Danube.—An important project is on foot for establishing a regular communication, by means of steam vessels, between Vienna and Constantinople, and, at some future period, in connexion with that project, a communication with the German Ocean and the English Channel, by means of the Rhine and the rivers which connect it, or nearly so, with the Danube. On the part of the Austrian government this affair has become, in some measure, a state object, and great numbers of the Austrian nobility, and the sovereigns and nobility of the contiguous German states, have embarked money in it. The project is not altogether a new one, a company having been formed (query, projected only?) in the year 1830, under a charter from the Court of Vienna, for the navigation of the Danube within the Austrian dominions, with which the present undertaking will naturally connect itself, and become an extension of it. The first object will be to establish the intercourse, by steam vessels, between Vienna and Constantinople, a distance of 1500 miles, and the estimate is, that this may be accomplished in ten days, allowing the vessels to come to anchor during the night; but that, when all the arrangements are completed, it is supposed that the voyage may be performed in seven days. Preparatory surveys made of the course of the Danube, by order of the Austrian government, are said to have afforded satisfactory proof that few natural obstacles exist, and those few easy of removal.—*Times, City Article.* The following additional information on the subject is extracted from the Parisian private correspondence of the *Times*:—"The only local difficulty, which has long stood in the way of the project, consists in a rocky part of the Danube, extending all along that river from Orsova to Ada Kalé, a distance of about twenty-five English miles. A very enterprising and wealthy Hungarian nobleman, Count Seczini, who has an estate which borders that part of the river, had for several years been at vast trouble and expense in trying to find some mode of dislodging the rocks, but he was compelled to give up the hope of doing so, though not of ultimate success in the object he had in view. A canal has been commenced, at his expense, over his estate, by means of which the rocky part of the river may be avoided altogether. This canal will serve the double purpose of avoiding the rocks and the distance formed by a circuitous direction that the river takes where they are situated. The canal was only commenced about three or four months ago, and will not be completed until next year. Hitherto the steam-boats going down the Danube started from Raab, in Hungary, a town situated half-way between Presburg and Buda, and proceeded only as far as Orsova, being prevented by the rocks from going farther."

Count Seczini (Czuecki?), the Hungarian nobleman mentioned in the last extract, is now in London, for the purpose (we believe) of procuring information connected with the prosecution of the undertaking in question.

A Correspondent at Boston (U. S.) informs us that Mr. Rutter's new mode of generating heat from coal-tar and water has been adopted at the gas-works there with great advantage. The proprietors have followed, without deviation, the process set forth by the patentee in his specification, and first published in our Magazine of the 14th September last.

"An Attentive Reader of the Undulating Controversy" proposes that a sum of money should be staked on the result of a trial of an undulating line. He requests us to ask, "Whether Mr. Badnall and Mr. Cheverton have confidence enough in their respective opinions, to come forward singly, or supported by their friends and advocates, and stake a sum of money on the event?" He for one, he adds, "would be happy to back Mr. Badnall." The wager, our correspondent suggests, might be laid so that "the winner should pay for the expense of the trial; which expense, in case of failure, would be merely that of laying down the rails and taking them up again, on any projected line." The sum he names is from 1,000*l*. to 2,000*l*.

John Fuller, of Rosehill, Esq.,—"Honest Jack Fuller" (sometimes "Eccentric Jack"), as he used to be called, before he abandoned the turmoil of political life for the quiet retreats of philosophy—before he gave up lecturing Speakers, and took to founding lectureships—has, besides establishing the Fullerian Professorship of Experimental Philosophy in the Royal Institution, now so ably filled by Dr. Faraday, lately invested a sum of 3,333*l*. 6*s*. 8*d*. three per cent. consols, for the endowment of a Professorship of Physiology in the same Institution; and another sum of 3,000*l*., three per cents., to form an accumulating fund for the general purposes of the Institution. The total amount of this gentleman's donations to the Royal Institution falls now little short of 10,000*l*. The members have testified their grateful sense of this extraordinary instance of munificence, by voting that a bust of Mr. Fuller shall have a distinguished place in the Library of the Institution. So much, some will say, for pelf—which exalts a mere country squire to the same honours as a Rumford and a Davy. Far be from us, however, so narrow a measure of justice! We say, on the contrary—so much for great wealth nobly and usefully employed; and may the admirable example of "Honest Jack Fuller" have many imitators among the squirearchy of England!

Communications received from Kinclaven—Mr. Badnall—S. P. A.—A Shareholder—Why so?—Mr. Erpingham.

Erratum.

Sir,—The printer has, by introducing the word "*improved*" in place of the word "injured," most completely misrepresented my opinion of the effects that will be produced on the property, not only near, but at a considerable distance, from the proposed "viaduct" over Chelsea, &c., if it be carried into execution. I am, Sir, yours, &c.

JOSEPH JOPLING.

31, Somerset-street, Portman-square.

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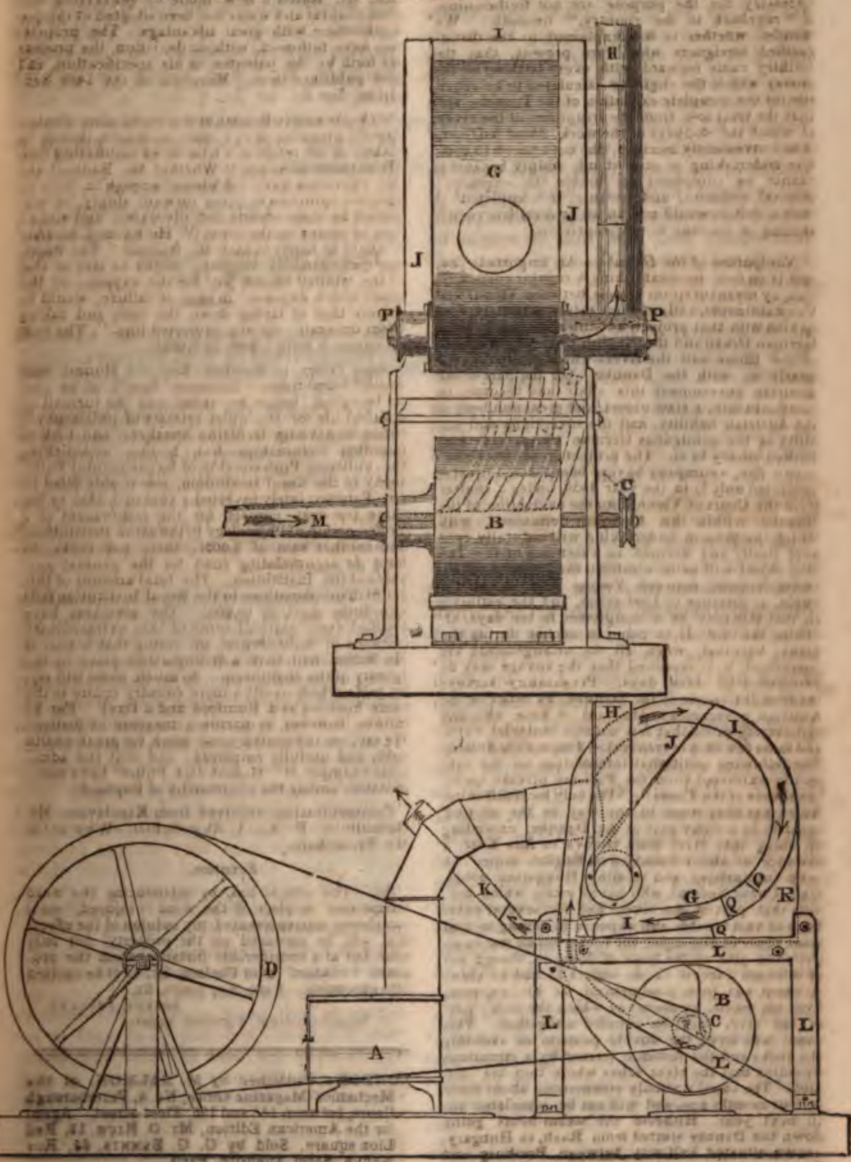
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 557. SATURDAY, APRIL 12, 1834. Price 3d.

REED'S PORTABLE AIR-STOVE AND VENTILATOR.



PORTABLE AIR-STOVE AND VENTILATOR.

Sir,—Having personally had painful experience of the evil effects of want of due ventilation in crowded workshops, more especially where particles of metallic dust are flying about, and stealing their way into the lungs, I am induced to send you a plan of a portable air-stove and ventilator, by the use of which in such places the atmosphere may at all times be kept perfectly pure and wholesome. I showed a working model of it, about three years ago, to an eminent physician, who thought it would be equally applicable to hospitals, lazarettoes, &c., and that it might be introduced there with very great advantage.

The lower figure exhibits an elevation of the apparatus, on a scale of a ¼ inch to a foot; and the upper one a cross-section, on a scale one-third larger.

A is a common cast-iron stove, such as is used in laundries, &c. The fuel may be either coal or coke. The heated air, &c. rises into an inner wrought-iron cockle marked G, whence the smoke escapes through the pipe or opening H. This cockle has an outward casing I I, of about 4 inches in diameter, round which a stream of air is driven in the direction indicated by the arrows, from the fanner B, and issues in a warm state at the mouth of the pipe K. There are two shutters J J, on each side of the cockle, to compel the stream of air to pass over the top of the cockle. L L L L is an iron frame, which supports the cockle, and contains the fanner. P P are doors by which to clean out the cockle occasionally. Q Q Q are stays, or supporters to the cockle. R is packing or false bottom, to prevent the radiation of the heat. D and C are the wheel and pulley-sheave by which the fanner is worked. They may be turned by hand, or any other convenient power, at the rate of from 200 to 250 revolutions a minute. M is a pipe, by which a supply of cold fresh air may be conveyed from the outside of the building to the fanner. The whole apparatus may be placed on a wooden frame, with only a few bricks for the stove to rest upon.

The large brick air-stoves, invented by that eminent mechanic, Mr. Strutt, of Derby, are on the same principle as the present. We have six of these at work at the mills where I am employed. I only claim the credit of making them portable, and all of sheet-iron, except the wooden foundation and wheel.

Such portable air-stoves would be particularly serviceable to architects, builders, &c., and might be lent for hire for 4*s.* or 5*s.* a day, in the same way as engine-makers are in the custom of letting out their copper pumps to well-sinkers.

I remain, Sir,
Your obedient servant,
WILLIAM REED.

Imperial Paper Mills, Peterhoff,
New Year's Day, 1834.

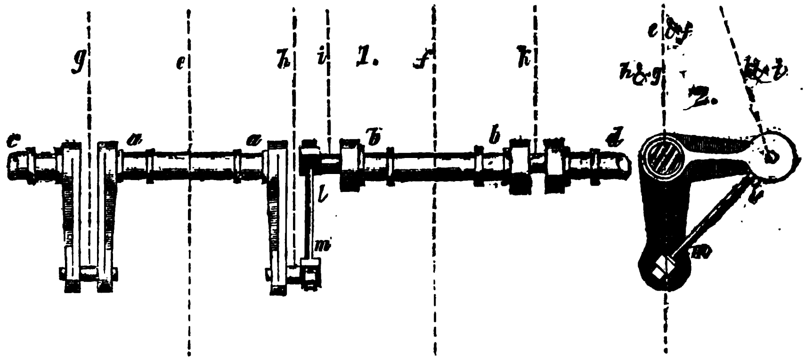
THE AMERICAN PRACTICE OF WORKING THE ENGINES OF STEAM-VESSELS SEPARATELY.

We extract the following interesting information, on this head, from a letter of Mr. Armstrong, the captain of the "John Bull," which plies between Quebec and Montreal, to Nath. Gould, Esq., Deputy Chairman of the North American Land Company, published in the *Nautical Magazine:*—

"The arrangement is simple, and depends entirely on the separation of the two engines; one of which drives the wheel, and between which there is no connexion whatever; except that in general both boilers are connected with the steam-pipes of each engine, in order to equalise the supply of steam. It will be clear to you that, under this arrangement, either engine, and consequently either wheel, may be worked a head, reversed, or stopped, independently of the other. This mode of applying the power of steam is entirely different from that adopted in England. There the feeling in favour of the connexion of the two engines is so strong, that the remaining engine is considered as nearly useless after its partner is disabled, whereas no inconvenience has yet been found here to result from the want of the connexion. Each engine works as easily, and passes the centre as well, as it could do if connected with the other, and may be stopped or reversed while the boat is under full speed, without any difficulty or danger. I may compare the steamer to a small row-boat with two oars, one backing and the other pulling, and *vice versa*, or both forward or both backward, as the occasion may require. The advantages of this arrangement in a

tow-boat, when getting under way from a wharf, or in a crowded port with vessels in tow, can hardly be too highly estimated. The boat can literally turn round and round in her own length, and the manœuvre is performed here daily. Nor is it in river boats only that this plan is adopted. On Lake Ontario, and in the boats passing through Long Island Sound from New York to Providence, it is universal. On Lake Ontario, the sea is particularly short and trying to a steamer, yet the "Great Britain" is now running from Prescot to Queenston, for the third summer, without having met with any accident, although she carries her boilers on deck, and although her two engines, of 80-horse power each, are perfectly unconnected."

SIMPLIFICATION OF STEAM-BOAT MACHINERY.



Sir,—The arrangements represented in the above figures will show that the steam-boat machinery, described in Number 513 of the Mechanics' Magazine, may be still further simplified, and put up in a more compact way, than it is there represented.

Fig. 1 shows the line of shafts running across the vessel; fig. 2 is an end-view of the same. In fig. 1, *a a* and *b b* are the short shafts, with two cranks on each, that work on the top of the cylinders; the cranks on *a a* are set at right angles to the cranks on *b b*. The shaft *c* drives the one paddle, and the shaft *d* works the other; *e e* and *f f* are the perpendicular lines passing through the centres of the cylinders; and the lines *g*, *h*, *i*, *k*, mark where the connecting-rods work; *l m* is a bolt, with a nut and ruff at each end, for connecting the pin of one of the cranks on the shaft *a a* with the pin of the crank on *b b*, that is next *a a*. By connecting the shafts in this way, we get quit of the intermediate shaft, with the two cranks on it at right angles to each other, for connecting the two engines, and also of the framing-work which supports it; and the engines take up less room in the breadthway of the vessel. The same letters are placed beside the parts in fig. 2.

Fig. 3.

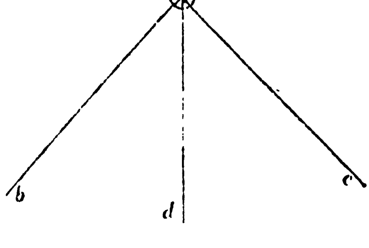


Fig. 3 is a diagram, showing the positions of the lines passing through the centres of the cylinders parallel to their sides, in the second plan; and is a more compact and simple arrangement than any of the preceding. Let *a* be the centre of the shafts, then *a b* will show the direction of the line passing through the centre of one cylinder, and *a c* will give the position of the centre line of the

other cylinder; the lines *a b* and *a c* are at angles of $22\frac{1}{2}°$ to the perpendicular line *a d*. The cylinders have no declination in the breadthway of the vessel, but are set at rather more than one half of the diameter of the piston-rods, off the perpendicular plane, passing fore and aft the vessel through the centre of its breadth. In this method, only one shaft with two cranks on it is needed; the engines take up just one-half of the room in breadth, and no more in length than in the other methods. The centre lines of the cylinders are not exactly in the centre of the breadth of the vessel, to allow the piston-rods of both engines, where they pass each other at the crank shaft above the cylinders, to work clear of each other.

To obtain an almost equable motion, without a fly-wheel, we must have three cylinders; one upright, and placed exactly below the crank-shaft; another perpendicular to the crank-shaft, and inclined to the first cylinder at an angle of 60°; the third is also perpendicular to the crank-shaft, and it is placed at an angle of 60° to the different side of the first cylinder; so that the second and third cylinders are inclined to each other at an angle of 120°. The plane, passing through the centres of the piston-rods of the first cylinder, should bisect the crank-shaft on the top of the cylinders; the plane passing through the centres of the piston-rods of the second cylinders, should cut the crank shaft a little to the one end of the shaft; and the plane passing through the centres of the piston-rods of the third cylinder, should cut the crank-shaft towards the different end, from the one cut by the plane passing through the centres of the piston-rods of the second cylinder. Setting the cylinders not exactly opposite each other, in this way, lets the piston-rods work past each other.

I am, with respect, yours,

JAMES WHITELAW.

Glasgow, Feb. 7, 1834.

THE STATURE AND WEIGHT OF MAN AT DIFFERENT AGES.

M. Quetelet, of Brussels, has lately published* the results of his investigations on the development of the weight of man, his growth, his inclination to crime, the succession of generations, &c. He proposes, hereafter, to publish new inquiries concerning the strength, swiftness, and other qualities of the human species; inquiries which, in order to be exact, must be made by many associated observers, and upon a great number of individuals.

The observations of M. Quetelet were made at Brussels, in the Maternal Hospice of St. Peter. He compares them with those made at Moscow and Paris, in similar hospices, and he finds little difference between the means obtained. Unfortunately, the Russian and French practitioners have not distinguished, with as much care as M. Quetelet, the sex, the stature, and the weight of children observed at their birth. This renders the results less capable of minute comparison.

M. Quetelet found for 63 male children, and 56 female, newly born, the following quantities:—

	WEIGHTS.	STATURE.
Male children	7·057536 lbs. avoird.	1·62732 imperial feet.
Female	6·4179468	1·58467

The extremes are:—

	BOYS.	GIRLS.
Minimum	5·1608232 lbs.	2·4701376 lbs.
Maximum	9·92466	9·936329

The mean weight, without distinction of sex, is 6·7377414 lbs. avoird. It has been found at Paris on 20,000 observations 6·74656332 lbs. avoird.

M. Quetelet has made similar inquiries concerning children from 4 to 12 years of age, in the schools of Brussels and in the orphan hospital—concerning young people in the colleges and in the medical school—finally, concerning old men in the magnificent hospice which has been constructed in the same

* A pamphlet in 4to, pp. 43. Brussels. 1833. Translated by the Rev. W. Ettershank.

city for a period of four years. The results have been completed by observations made upon isolated individuals, taken by chance from the mean of all these *data*. M. Quetelet does not consider the results obtained in hospitals and public schools to be very exact as to the mean stature of the population, because inquiries made by him, concerning a great number of individuals, have proved to him that the mean stature is a little more among individuals in easy circumstances, than in the indigent population who have recourse to hospices, hospitals, and gratuitous schools. The following table, which we may consider as exact for the whole population of Brussels, and which, for want of a table of this sort, calculated for other countries, may serve, at least, as an approximation for the Caucasian race, and in a temperate climate:—

A Scale of the Development of Stature and Weight.

Ages.	MALES.		FEMALES.	
	STATURE.	WEIGHT.	STATURE.	WEIGHT.
Years.	Imp. Feet.	lbs. Avoird.	Imp. Feet.	lbs. Avoird.
0	1·64045	7·05736	1·60764	6·4179468
1	2·29007	20·841786	2·26382	19·3861692
2	2·59519	25·0101432	2·56238	23·5324716
3	2·83469	27·5023356	2·79532	26·0026092
4	3·04468	31·3839804	3·00102	28·67124
5	3·24153	34·7804194	3·19559	31·6706928
6	3·43511	38·7982752	3·38261	35·28768
7	3·62539	42·984168	3·56305	38·6841192
8	3·81240	45·7857648	3·74351	42·0805584
9	3·99942	49·954122	3·92067	47·1040528
10	4·18314	54·0783696	4·09457	51·8728896
11	4·3636	59·768508	4·26189	56·570562
12	4·54404	65·7674136	4·43905	65·7674136
13	4·72122	75·8244024	4·60310	72·6485112
14	4·89838	85·4844048	4·76714	80·941116
15	5·07227	88·69745824	4·91807	89·035276
16	5·22975	109·5461916	5·03618	96·0927636
17	5·36099	116·559618	5·10179	104·3412588
18	5·43973	127·587018	5·13132	112·5456444
20	5·49222	132·4611288	5·15757	115·3024946
25	5·51191	138.7909564	5·17398	117·5079744
30	5·52503	140·378802	5·18054	119·8237284
40	5·52503	140·4229116	5·18054	121·8086604
50	5·49222	139·9597608	5·03946	123·8597568
60	5·37740	136·074312	4·97384	119·757564
70	5·32490	131·2701696	4·96728	113·6042748
80	5·29219	127·5429084	4·94103	108·884576
90	5·29219	127·542084	4·93775	108·8183832

We see from this table, 1st, that at an equality of age the male is generally heavier than the female—towards the age of 12 years only an individual of either sex has the same weight. 2dly, That the male attains the maximum weight about the age of 40 years, and that he begins to lose, in a very sensible manner, towards his 60th year—that at the age of 80 years he has lost about 13·23288 lbs. avoird., the stature being also diminished 2·75604 inches. 3dly, That the female attains the maximum weight later than the male, towards the 50th year. 4thly, That when the male and female have assumed their complete development, they weigh almost exactly 20 times as much as at the moment of their birth, while their stature is only about 3¼ times beyond what it

was at the same period. Children lose weight during the first three days after their birth; at the age of a week they begin sensibly to increase; after 1 year they have tripled their weight; then they require 6 years to double the weight of 1 year, and 13 to quadruple it.

To calculate the burden of an edifice, or a bridge, covered with a crowd, it is well to know, that the mean weight of an individual, whatever is the age or sex, is about 98·584956 lbs. avoird.; that is, 103·65756 lbs. for the males, and 93·7328 lbs. for the females.

The inferior parts of the body are developed more than the superior. In a child the head is equal to a fifth part, and in a full-grown man to an eighth of the whole height of the individual. These proportions vary a little among different nations.*

Δ.

April 2.

CHEAP GALVANIC BATTERY.

1.

2.

Sir,—There is hardly any apparatus more acceptable to the experimental philosopher than an effective galvanic battery; but the price usually demanded for these instruments is such as to keep them out of the hands of all but the wealthier class of experimenters. The following description will enable any person, by the help of an ordinary brasier, to obtain a cheap galvanic battery, adapted to all the purposes for which such an apparatus is required. It is well-known that the general applications of galvanism require two modifications of it, usually obtained by two distinct sets of apparatus. Thus:—either a large quantity of the galvanic fluid is required of feeble intensity, as in Dr. Hare's calorimotor, or in electro-magnetic experiments, for which a single pair of plates of large dimensions is used; or else a small quantity of the fluid is required of sensible intensity, as in chemical decompositions, or medical applications of galvanism; for which purpose it is necessary to employ a considerable number of pairs of plates, or alternations of copper and zinc, of small size.

The apparatus, of which I have prefixed a rude sketch, is susceptible of either of these modifications, so that it may be converted at pleasure either from a caloric or electro-magnetic battery to a chemical one, or the contrary, in a few minutes, and without any soldering or other tedious process.

The copper plates are double cylinders soldered together at the bottom, like that first described (I believe) by Mr. Sturgeon, having between them cylinders of zinc, which are kept from contact with the copper by pieces of wood at the bottom and sides. To each of the zinc cylinders, as well as to each of the outer copper cylinders, are soldered, on opposite sides at the top, a pair of flat copper sockets, into which a thin slip of copper may be inserted for the purpose of connecting the different pairs of plates. The interior of these sockets must be silvered with nitrate of mercury, as must also the extremities of the copper slips which are inserted into them, and should also contain a drop of fluid mercury at the bottom. The copper slips being bent into arches are to be inserted into the flat sockets, as in the above sketches, where the dotted lines denote the sections of the zinc cylinders, and the rest those of the copper cylinders.

If a chemical battery be required, insert the slips or arches as in fig. 1, which represents a battery of three pairs of plates—if a calorific or electro-magnetic battery be required, insert the arches as in fig. 2, which evidently represents a battery of a single pair of plates. It is hardly necessary to add, that a variety of combinations may be made out of the same set of cylinders, affording any required modification

* From a paper in Jameson's Edinburgh Philosophical Journal. Jan. April. 1834.

of the galvanic power as to quantity and intensity. Should any further particulars be required, I shall have great pleasure in supplying them.

And am, Sir,
Yours respectfully,
WILLIAM COOK.

Monks Kirby, March 11, 1834.

THE UNDULATING RAILWAY — FINAL REPLY OF MR. BADNALL TO MR. CHEVERTON.

Sir,—Mr. Cheverton's dreadful infliction—HIS ROD hath, at last, fallen upon me, without his own character or the good taste of your readers being, in the slightest degree, "ill-consulted"—without the most distant apparent inclination to render your pages the medium of a personal quarrel between himself and me! HE will not descend to imitate my dull—vituperative style! HE would shudder to characterise an opponent as "a coarse practitioner from the *abattoir*!"—"a mere hacker of flesh and bones."! HE is a man of more gentlemanlike bearing than to fume out false accusations! No, Sir, HE stands upon too lofty an eminence! HIS philosophic and refined understanding could not possibly stoop to mere personal abuse, or controversial subterfuge! No, HE is the very prototype of wisdom!—an immortal emblem of refinement!—a breathing picture of urbanity and peace!—gentle as a lamb—sweet as honey—mild as new milk—"*parfaite amour*" in toto! HE is not the cur who, when he meets with an unflinching antagonist, flies growling and barking to his kennel!—HE is not the tame-hearted pugilist who swears that a blow is false because he cannot parry it!—nor is HE slippery as the eel, which, by its twistings, and its twinings, and its slime, evades the grasp of its pursuer, and buries itself in its native mud! No, Sir, Mr. Cheverton is a being of far different stamp!—his mental qualifications—his scientific reputation—his temper—his writings—his sentiments—will *all* bear the test of the most rigid scrutiny! HIS theories will *all* be established by practical results! The halo round HIS head will brighten as each opinion becomes confirmed by experiment! In a word, HIS letters on "the undulating railway," while they will immortalise the fame of the *Mechanics' Magazine*, will become never-dying monuments of sterling talent and correct observation, from the hour when *that trial* takes place, which a DALTON* has been indiscreet enough to recommend! Till that hour arrives, I almost feel inclined to "leave him alone in his glory," in order that I might, with double effect, magnify his transcendent name, and prostrate myself before this living monument of wisdom! But—I cannot resist the inclination, which his last letter has excited, to pay him some passing homage; for neither the "war-whoop of the Mohawk"—nor the "inspiring blast of the clarion," shall be compared to the sounding of his brass, or the tinkling of his cymbals!

Yet how shall I, to whom "nature has been so niggardly," sufficiently extol the praise of one, who, declining to quarry all ignoble game, is able to defend himself against a weapon capable of dividing "soul from body," the very "marrow from the bones."?

Immortal champion!—inspired philosopher!—tender and kind-hearted victor! may this humble panegyric be a memento of my deference to thy fame, as long as the *Mechanics' Magazine* may survive the wreck of time—and may that be for ages!

Having thus, Mr. Editor, in sincere good humour, squared one part of my account with Mr. Cheverton, I beg to acknowledge, like him, the gratification which I feel at the prospect of this too-lengthened controversy being terminated. The venom which he thought it prudent, *in the first instance*, to cast on me, I good-humouredly endeavoured to throw back; but his last effusion was of so different a nature—so characteristic of a noble and unoffending disposition, that I have met it, as it deserved, with an unbounded expression of veneration. As you have admitted, in your valuable columns, his unmeasured declamations, I trust that equal justice may be done to me; and that you will, by publishing this reply, permit me the opportunity of proving that he who cannot, by fair and manly argument, defeat a lite-

* Alluding to the trial of the undulating railway, which Drs. Dalton and Lardner have recommended to be instituted on the London and Birmingham line.

rary or scientific opponent, stands little chance of doing so by an opposite course of conduct.

Such was my object in noticing Mr. Cheverton's extraordinary letter (vol. xx. page 73). Had it been otherwise, my silence should have shown my contempt for the vulgar sneers and false accusations with which that document abounded. But it is passed, and I congratulate Mr. Cheverton on the victorious result of his attack.

As no unnecessary time will now be lost in trying by ample experiment, on some line or other, the merits of the undulating question, I would propose to your readers in general, that all further controversy should rest until the experiment be made. Practice can alone determine whether I or my opponents have been right or wrong in our anticipations, and whether Mr. Cheverton's arguments or mine will be creditably substantiated. The note which you have attached to my last communication, leads me to hope that you may concur in my present opinion;* and if so, while Mr. Cheverton may try at his leisure any further experiments he may please at the National Gallery of Practical Science, I will direct my attention to the means of elucidating the problem in a far more satisfactory way. If, on a trial being made, I find myself in error, I will frankly confess my incompetency to argue this subject, and my folly, at having so warmly and so boldly espoused it—if otherwise, I trust there are many of your readers who will give me credit for some patience, and for some intellectual capabilities beyond the *canaille* sphere in which Mr. Cheverton has been so anxious to place me.

The test shall not be less difficult than I originally proposed.—Whether the experimental railway be 6, 8, or 10 miles in length, I maintain, that *any locomotive engine will traverse an undulating line with a load which is its maximum load on a level, in half the time which it will occupy in traversing the same distance with the same load on a dead-level railway, and without greater waste or consumption of fuel.* And I, moreover, say, *that any locomotive engine will traverse an undulating line at a great velocity with a load* which that same engine cannot move upon a level line.*

Whenever this trial may take place, your readers shall have ample notice of it; and if you, Sir, will undertake the office of umpire, I shall cheerfully abide by your decision.

In the mean time, it would be mere repetition, and an unnecessary prolongation of our arguments, were I to reply at length to the more solid parts of Mr. Cheverton's last letter. One or two points, however, I cannot help touching upon.—First, as to "*locomotive duty*," which he so frequently harps upon. *All* my arguments, of late, have been almost confined to the practical consideration of locomotive duty. *I do* say that by employing gravity as an *auxiliary* force, *we save* locomotive power. What! Mr. Cheverton exclaims, can you take advantage of gravity without being obliged to repay what you borrow? *Yes*, is my reply—and yet *no perpetual motion*, Mr. Cheverton! How? Mr. Cheverton would ask. My answer is simply this, and whether it be true or false, *experience will prove—velocity* is *gained* by taking advantage of gravity. *Friction* on railways is, in my humble opinion, *not as the spaces*, but as the *times or velocities*. If this be true—and if a *greater velocity* be attainable on an undulating than on a level railway, there is (exclusive of any difference in friction arising from the particular inclination of the plane) *less friction on an undulating than on a level railway*. Locomotive steam power is therefore *saved*.

The next point I wish to allude to, is Mr. Cheverton's observations about a lecture given to me, or some of my acquaintances, by Professor *******, in the National Gallery. Does he mean Professor Ritchie?—if so, I was not present. That gentleman and Mr. Locke had, I know, a conversation together; but the only time that I have had an opportunity of conversing with Professor

* We do perfectly; but it must be with reservation of the claims of Mr. Whitehead and Mr. M'Kinnon, to whose papers, in opposition to the undulating system (now many months in hand), we stand pledged to give insertion. We shall be glad to have their assent to the postponement proposed in the text.—Ed. M. M.

* It will occur to your readers that I have frequently stated as my opinion, that an engine would convey, on an undulating line, *at least* twice the load which the same engine could move on a level, at the same velocity. Such is my opinion now; but the test which is above proposed will, I am sure, be deemed sufficient to decide the question at issue, and it will be found to accord with the terms of my original challenge.

Ritchie on the subject, was recently, when he did me the honour to spend part of the day with me in Liverpool. In a word, the only individuals whom I can call to mind as having expressed a decided opinion in my presence, when in London, adverse to the undulating railway, were Mr. Saxton and a friend of his, whom I begin to think was Mr. Cheverton; and as to any acquaintance of mine then present being afraid of their "*badgering*," I *rather think* Mr. Cheverton has imbibed an erroneous impression. If it were necessary, I could publish, in this letter, a list of persons who are advocates of the undulating railway, amply sufficient to out-balance the strongest testimony which Mr. Cheverton and his friends can advance against it,—but the best testimony is *practice*, and *upon that I throw the merits of the case.*

Lastly, Mr. Cheverton offers some important practical objections, which I confess to be more worthy of notice than *any points* which he has hitherto advanced. But, serious as they appear, they will not, on consideration, be found of any real weight. In the first place, we have to determine what is a *safe velocity*—that being determined, how can it be attained on a level railway with heavy loads? Unless gravity be employed at starting, as an auxiliary force, a much more powerful engine would be requisite to *move* a heavy load from a state of rest, than to continue it at a given maximum velocity; and *if gravity be employed at starting*, the engine and load *must ascend again to a like summit*, in order to maintain the starting advantage; and *if so*, what is this but an undulating railway? Does Mr. Cheverton imagine that a perfect cycloid, or a perfect arc, alone constitute my idea of an undulation? Far from it—he may descend a hill, run four miles on a level, and ascend to an equal elevation; and by doing this would realise a system of undulation which might, probably, be adopted with advantage in some cases; for, with heavy loads, a velocity might be generated by the first descent which could not, with the same engine, be generated on a dead level; and this being maintained on the level, would enable the load to ascend to a like elevation. But supposing the undulations to be a series of regular segments of circles, wherein consists the difficulty of sustaining an average velocity of 20 or 30 miles per hour, without an increase of speed? Is it necessary to work the engine down every descent? One of the leading advantages which I anticipate, is the great saving of that steam expenditure which is now necessarily incurred in maintaining high velocities on a level. Again, it will require very powerful engines to attain high velocities, with heavy loads, on level railways: whereas, such powerful engines will *not* be so necessary on undulating railways, and for the reasons previously stated.

I now, Sir, unless again attacked by Mr. Cheverton, close with pleasure this twelvemonths' warfare, anxiously awaiting the result of practical trials; and sincerely hoping, although a few waspish observations have occasionally intermingled with a subject to which they should have been altogether foreign, that some information and benefit may have been derived from the discussion.

I am, Sir, with great respect,
Your very obedient servant,
RICH. BADNALL.

Douglas, March 27, 1834.

P. S.—S. Y. and I have, in one respect, misunderstood each other. He is certainly right in believing that the pressure upon an inclined plane (alluding to the force necessary to draw a body up) is as the base to the length: therefore, at an angle of 45°, my statement appeared erroneous; but, taking into consideration the resolution of the forces—that at an angle of 45° the length of the base is equal to the perpendicular elevation—and that taking the length of the plane as the entire force of gravity, it forms the diagonal to two equal sides of a square; the oblique forces are therefore equal—that is, at an angle of 45°, the force of gravity which urges a body down a plane, or retards its ascent, is exactly equal to the force of pressure on the plane. For instance, if L be the length, B the base, and E the elevation, at an angle of 45°, E is equal to B; and although the pressure on the plane is $\frac{B}{L} \times L$, yet the tendency to descend is $\frac{E}{L} \times L$; the one force, therefore, is equal to the other. I close my discussion with S. Y. with every feeling of respect.

PRACTICAL HELPS TO A CHEAP COURSE OF SELF-INSTRUCTION IN EXPERIMENTAL CHEMISTRY.

Sir,—The extensive utility of chemical knowledge has caused it to be very generally, nay, almost universally, cultivated; but it is a branch of philosophy so entirely founded on experiment, that no person can understand it so as to verify its fundamental truths, unless he conducts experiments himself; it cannot, therefore, be uninteresting to devise such modes as may render the performance of these experiments easy, either by simplifying the apparatus, or by presenting such expedients and resources as shall readily be within the reach of every student. Some one has remarked that no good chemist can have clean hands; I will not admit as much as this, but it is universally acknowledged, that unless he operates himself, *propriâ personâ*, and conducts his own experiments and analyses, he can be no real chemist. No one could be called a great traveller, who had only read books of voyages and travels by his fireside, though they comprised every one from Sir John Mandeville to Captain Ross. How, then, can we acknowledge a person to be a chemist whose science is founded on the authority of others, and who, when he finds himself in conditions for which he has no precedent in his books, is completely at fault? One experiment, well conducted and carefully observed by the student from first to last, will afford more substantial and *permanent* knowledge than the mere perusal of whole volumes; and, it may be added, that chemical operations are in general the most interesting that could be devised, were it merely for the sake of amusement.

Let us then proceed to examine some of the "means, and appliances to boot," that young chemists should possess. Dr. Henry truly remarks, that the notion that a laboratory, fitted up with furnaces and expensive and complicated apparatus, is absolutely necessary to perform chemical experiments, is exceedingly erroneous; in fact, diametrically opposite to the truth. For all ordinary chemical purposes, and even for the prosecution of new and important inquiries, very simple means are sufficient. Some of the most interesting facts may be exhibited by the aid of merely a few Florence flasks, a few common phials, and wine-glasses. Many most important discoveries in chemistry were made by persons who, either from choice or necessity, had recourse to utensils of the simplest character; for example, Dr. Paris, in his life of that admirable philosopher, Sir H. Davy, gives an amusing account of the extasies of the then young chemist, on his receiving an obsolete glyster apparatus from a French surgeon, who was shipwrecked on the coast of Cornwall, and his adapting this clumsy machine to the performance of his early and brilliant experiments on light and heat.

For the guidance of the chemical student, I have drawn up the subjoined list of articles which it is *desirable* he should be possessed of before commencing a course of experiments; several of them might certainly be dispensed with, but from the prices which are also added, it will be seen that the *whole* are within the reach of persons of even the most moderate means. They may be procured of great purity (and this is highly essential) of Mr. Dymond, 146, Holborn-bars; or of Mr. Davy, 390, Strand. I should recommend that the phials be arranged on narrow shelves, with a slip of leather nailed about an inch from the wall against which the shelf is fixed, and about three inches above the shelf, in which to support the phials. A good sound cork will securely close the mouths, except for volatile or corrosive liquids, for which bottles with ground stoppers are necessary. They must all be labelled according to the chemical nomenclature, as "Sulph. Soda," "Nitrate Potass," &c. Another mode is to label compound bodies according to their atomic composition, by which means the proportional quantities of each constituent is constantly presented to view, and consequently easily borne in mind. For example, carbonate of potass is composed of one atom or equivalent of each constituent; I therefore write *Potass + carbonic acid*, *i. e.* potass plus, or added to, carbonic acid. The bi-carbonate would of course stand thus, *Potass + 2 carbonic acid*, or one atom of the alkali plus 2 of carbonic acid. To resolve them into their ultimate elements is, I think, unnecessarily complicated; otherwise the salt in question would stand, *Oxide of potassium + carbon with 2 oxygen* (for

carbonic acid) But in metallic salts, popularly so called, it is necessary to signify that it is invariably the oxide of the metal that combines with the acid, and not the metal directly; thus sulphate of iron is *Peroxide of iron + sulphuric acid*. The student will readily perceive that, as the atomic weight of iron is 28, of oxygen 8, and of sulphuric acid 40, the resulting compound will have the sum of them, or 76, for its combining proportion or equivalent. But to enlarge on this subject is not my present purpose, further than to suggest this mode of labelling chemical preparations to those who are already advanced in the science. The former and simpler mode will perhaps be the best for the adoption of beginners. The atomic proportions of the various salts, &c. may be found in many modern works on chemistry.

LIST OF CHEMICAL PREPARATIONS, &c.

Acid sulphuric ½ lb., per lb. 6*d*.
muriatic 4 oz., same price.
nitric 4 oz., per oz. 2*d*.
oxalic ½ oz., per oz. 4*d*.—This acid is an excellent test for lime in solution, with which it gives a white insoluble precipitate of oxalate of lime.

The three first acids must be kept in stopper-bottles, and mark always to take up with the stopper, before replacing it, the drop adhering to the neck of the bottle.

Potass carbonate 1 lb. 8*d*.—This is the sub-carbonate of the drysalters—it is purified by re-crystallisation.
bi-carbonate 5 oz., per oz. 3*d*.
caustic 1 oz., per oz. 6*d*.—Procured in small sticks, resembling slate-pencils—it must be kept well excluded from the air, to prevent the absorption of carbonic acid.
prussiate, or, more properly, ferrocyanate, 1 oz., per oz. 4*d*.
chlorate 2 drachms, per oz. 1*s*.
bi-tartrate (the common cream of tartar) 1 oz. 2*d*.
nitrate (saltpetre) 2 oz., per oz. 1*d*.
Soda carbonate 2 oz., per oz. 2*d*.
bi-carbonate 2 oz., per oz. 3*d*.
sulphate (Glauber salts) 2 oz., per oz. 1*d*.
Ammonia liquid 2 oz., per oz. 2*d*.
carbonate 1 oz. 4*d*.
muriate (sal ammoniac) 2 oz., per oz. 2*d*.
Lime fluate (the fluor spar of the dealers in minerals) 1 lb. 6*d*.
Magnesia carbonate 1 oz., per oz. 4*d*.
sulphate (Epsom salts) 2 oz., per oz. 1*d*.
Alumina and potass-sulphate (alum) 2 oz., per oz. 1*d*.
Iron sulphate (green vitriol) 2 oz., per oz. 2*d*.
Copper sulphate (blue vitriol) 1 oz. 2*d*.
Lead acetate (sugar of lead) 1 oz. 3*d*.
Barytes muriate ½ oz., per oz. 8*d*., or instead—
solution ½ oz., per oz. 6*d*.—A most sensible test for sulphuric acid, also for carbonic acid. For this latter it is so delicate, that, by simply pouring it from one vessel to another, a copious white precipitate is thrown down. It must be kept well stopped.
Strontia carbonate, together with carbonate of barytes—may be purchased of dealers in minerals (native).
Borax 1 oz. 3*d*.
Tin 1 oz. 3*d*.
foil 1 square foot 3*d*.
Bismuth 1 oz. 6*d*.
Mercury 3 oz. per oz. 3*d*.
Zinc granulated 1 lb. 6*d*.
Iron-filings 1 lb. 6*d*.—The two latter to make hydrogen gas.
Antimony sulphuret 2 oz., per oz. 1*d*.
Manganese, black oxide, 1 lb. 4*d*.
Cobalt 1 drachm 3*d*.
Tincture of litmus and nut-galls ½ oz. each, per oz. 3*d*.
Turmeric ½ oz. 2*d*.
Phosphorus ¼ oz., per oz. 5*s*.—To be preserved under water, with the light excluded.
Alcohol 4 oz., per oz. 2*d*.
Roll-sulphur, flowers of sulphur, chalk, pipe-clay, red-lead, of each a pennyworth.
Some lumps of white marble, to make carbonic acid gas.
Some newly burnt charcoal.
Some thick polished iron and copper wire.
Small articles of apparatus of great utility:—An iron ladle; a deep iron pot, to serve as a sand-bath; another for a water-bath; glass rods; clean straws and pieces of tobacco-pipes, to stir mixtures with; a few pasteboard and wooden boxes, with spare corks; a brass blow-pipe, which may be bought at the ironmongers for 9*d*.; a couple of Wedgwood-ware evaporating basins, utensils of great utility, as well for crystallisation as evaporation, as a strong heat may be applied to them without any danger of cracking, and they are unacted on by acids (those marked Nos. 5 and 7 are the most

useful sizes, and cost, respectively, 9*d.* and 1*s.* 6*d.* at the china-shops); a Wedgwood-ware pestle and mortar, which may be bought at the same place, and they are of great strength (No. 1 is a convenient size, and will cost 2*s.* 4*d.*); a ribbed-glass funnel, for filtration, &c., which will cost 6*d.* or 8*d.*; some glass tubes, of different sizes and bores, with which, by the aid of the blow-pipe to form small retorts, &c., ½ a lb., at about 2*s.* 6*d.* per lb., at the glass-blowers.

I have already protracted my letter to a great length, and must, therefore, reserve for my subsequent communications a notice of some other essential articles of apparatus, and of such substitutes as may easily be made at home, to answer the purpose of the more costly productions of the instrument-makers.

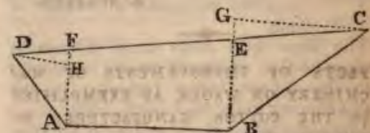
I remain,
Your obedient servant,
BRACKSTONE.

MR. MACNEILL'S TABLES FOR CALCULATING EARTH-WORK.

Sir,—Although I have never seen Mr. Macneill's Treatise on the Cubical Contents of Earth-work, I will venture to make a few remarks on what has appeared in the Mechanics' Magazine regarding the accuracy of some of the rules in that work. Mr. T. O. Blackett, in Number 546, contends that Mr. Macneill has fallen into an error in the rule which he has given for finding the area of a vertical section of an embankment, declining from the horizontal line. Mr. Macneill's rule is stated to be this:—Let d and d' be the perpendiculars, b the base, r the ratio of the slopes (this ought to have been "*r the sum* of the ratio of the slopes,")—then $r\,d\,d' + \frac{d+d'}{2}.b =$ area of a vertical section.

It is quite clear, from Mr. T. O. Blackett's first article on the subject (546), that he had no idea how the quantity r is determined from an actual measurement. He has, therefore, been under the singular necessity of applying his scale and compasses to Mr. Macneill's own diagram to determine the accuracy of the rule. Now, even granting that Mr. Macneill's diagram was perfectly constructed, Mr. Blackett has not taken the proper lines for determining the area (see fig. 2). In his answer to Mr. D. M'Callum (No. 555), he states that that gentleman has contrived to bring out an answer agreeing with that of Mr. Macneill's, by means of a false diagram. This is certainly true; and, moreover, Mr. M'Callum does not appear to know how the quantity r is to be determined, so as to prove the truth or fallacy of the rule; his diagram is truly inconsistent with the question.

Mr. Blackett has attempted another solution (No. 555), which, I am sorry to say, is not a whit better than the first. He has calculated, by trigonometry, the line E F (see his own diagram), and the angles G E F, C F D, and the area of the quadrilateral E B C F, all rightly; but he has taken care to conceal the method he had recourse to in finding the area of the triangles E C D and A B E. The truth is, he has been obliged again to trust to the accuracy of his scale and compasses. But be that as it may, I maintain that Mr. Macneill's rule is perfectly correct.



Let A B C D represent a vertical section of the cut. Draw A F, B E, C G, D H, perpendicular to A B, B E, and A F. Assume B E $=d$, A F $=d'$, AB $=b$. Then $\frac{d+d}{2}.\,b =$ area of the quadrilateral A B E F. Now, let r be such a quantity that $r \times$ B E $\times$ A F, or $r\,d\,d' =$ to the area of the two triangles B E C and A F D; then $r\,d\,d' = \frac{BE\,.\,CG}{2} + \frac{AF\,.\,DH}{2} = \frac{d\,.\,CG}{2}\ \frac{+d'\,.\,DH}{2}$; hence $2\,r\,d\,d' = d\,.\,CG + d'\,.\,DH$ and $r = \frac{d\,.\,CG}{2\,d\,d'} + \frac{d'\,.\,DH}{2\,d\,d'} = \frac{CG}{2\,d'} + \frac{DH}{2\,d}$. So that to determine r the perpendiculars C G and D H must be each measured, and the quantities $\frac{CG}{2d'}, \frac{DH}{2d}$, are called the ratios of

the slope. Thus in the question, $\frac{CG}{2d'}=1$ $\therefore CG=2d'=12$ and $\frac{DH}{2d}=\frac{1}{2}\therefore DH=d=8$, and $r=1+\frac{1}{2}=1\frac{1}{2}$ and $\frac{d+d'}{2}\,b+r\,d\,d'=112+72=184$. Hence it appears that Mr. Macneill's rule is true.

It might, no doubt, be asked—if it is necessary to determine each of the perpendiculars C G and D H by measurement, then, may not the area of the figure A B C D be calculated at once, without finding the value of r? And does not Mr. Macneill's rule only tend to mystify the subject? As I have never seen Mr. Macneill's book, I am not prepared to answer these questions in the negative. In all probability, however, Mr. Macneill must have had some good reasons for giving the rule under the form which he has done. Should the book ever happen to fall into my hands, I shall read it with attention, and communicate the result of my opinion of it to the readers of the Mechanics' Magazine.

Yours, &c.

KINCLAVEN.

EFFECTS OF IMPROVEMENTS OF MACHINERY ON WAGES, AS EXEMPLIFIED IN THE COTTON MANUFACTURE. BY JOHN W. COWELL, ESQ.

(From a Supplementary Report of the Factory Commission.)

Improvements in machinery in all that regards cotton-working are not stationary for a single moment. The machinery which to-day is the most perfect becomes to-morrow second-rate, and very soon third-rate. The cotton, in its progress from the hands of the porter of the mill who unpacks the bale which comes from the merchant, to those of the overlooker of the mill who receives it from the spinner in the state of twist or yarn, (and which is the first shape in which it becomes once more a marketable commodity,) goes through a number of processes which it would be difficult to enumerate and impossible to describe. Each of them has its peculiar system of machinery, and an improvement in that appropriated to any one of these, affects directly the wages of labour in the process itself, and indirectly those in other correlate processes.

Improvements in machinery produce their effects on the price of labour in the following ways:—

First, They render it possible to fabricate some articles which, but for them, could not be fabricated at all.

Secondly, They enable an operative to turn out a greater quantity of work than before, time, labour, and quality of work remaining constant.

Thirdly, They effect a substitution of labour comparatively unskilled for that which is more skilled.

The first of these effects does not suggest considerations of such immediate importance to my present purpose as the two latter. They teem with consequences deeply affecting important social interests.

The following is the principle upon which wages or earnings, in cotton-working *by power*, depend, and I beg particular attention to it:—

When the quantity of work executed by an operative in a given time is increased in consequence of an improvement in the machine on which he works, his remuneration *per hour* increases, his remuneration *per pound of work done* decreases.

This principle obtains throughout, though many of the assistants are paid by fixed weekly wages; but as such are either in the direct employ of the superior operative, who is paid according to the foregoing rule or else under the entire control of the overlooker of a room of machinery, who is paid according to the quantity of work that his room turns out in a given time, the principle in reality prevails throughout.

To illustrate the effect which an improvement in machinery produces on earnings, I will take an instance from the spinning-department. It will hold good *mutatis mutandis* for every other department.

The spinner is the leading and most important operative in cotton working. He is the one for whom every preliminary process (called "the preparation," and consisting of carding, &c. &c. &c. &c.) is performed. So much weight of prepared cotton is delivered to him, and he has to return by a certain time in lieu of it a given weight of twist or yarn of a certain degree of fineness, and he is paid so much per pound for every pound that he so returns. If his work is defective in quality, the penalty falls on him; if less in quantity than the minimum fixed for a given time, he is dismissed, and an abler operative procured. The productive power of his spinning-machine is accurately measured, and the rate of pay for work done with it decreases with (though not *as*) the increase of its productive power.

Since these machines are in a state of continual improvement, what effect is thereby produced upon the spinner's earnings?

The mule, or spinning-machine, is a *system* of spindles. A spinner manages two

of them at the same time. He stands between them; one is always advancing while the other is retreating, and he turns from one to the other at regular intervals. The one which is advancing draws out the cotton (roving) from the back, and moves slowly towards the spinner, spinning the thread the while. The greater the number of spindles, the greater is the number of threads, and the higher the productive power of the machine. The mules vary in the number of spindles they carry from 200 to 800 each; or for the pair, from 400 to 1,600. The spinner has from one to six juvenile assistants, according to the magnitude of his spinning-machine, whom he engages and pays himself, without reference to his masters.

The number of spindles measures the productive power of the machine, and the masters and men agree upon a scale of prices for labour varying accordingly. These scales are printed.

The following is one of them. It is that at present in force in Manchester.

The first line will explain all the others. It signifies that a spinner, spinning yarn of the fineness of eighty hanks to the pound, on a mule the productive power of which is represented by 336 spindles, is to be paid at the rate of 4½*d.* the pound of yarn; that if he spins on one of a productive power represented by 348 to 384 spindles, he is to be paid 4¼*d.* per pound; and if on one of the productive power of 396, at the rate of 4*d.* per pound, and so on, the rate of pay for work done diminishing in proportion as (though not in the *same* proportion as) the productive power of the machine increases.

I give two of these documents, the one actually in force at Manchester dated 5th March, 1831, and the one which it superseded. This latter is dated 20th March, 1829, and is more in detail.

No. signifies "number of hanks of yarn to the pound." The figures 336, 348, 396, signify mules carrying respectively those numbers of spindles, and consequently yielding by each effort (technically called the "stretch"), 336, 348, or 396 threads of a given length.

(Here follow the scales alluded to.)

If these documents be inspected, it will be seen that the ratio of the diminution in the payment for work done is less than that of the increase of the productive power of the machine. Hence the perfect machine enables the operative to earn more money in a given time than the imperfect machine.

While I was at Manchester, the predominant fear among the most intelligent operatives was, that improvements in machinery would gradually "drive their wages down to nothing," and this was one of their motives for agitating for the Ten Hour Bill. This measure, they thought, by lessening production, would counteract the tendency of improvements in machinery, and keep their actual earnings steady. It is certainly important to examine the foundations of an opinion which produces, as we have seen, such extensive influence upon the social action of large bodies of persons.

By adverting to the document which stands first it will be seen, that a spinner spinning twist of the fineness of eighty hanks to the pound, on a machine of the productive power represented by 336, is paid at the rate of 4½*d.* for every eighty hanks that he turns off, while, if he spins on one of the superior power of 396, he is only paid at the rate of 4*d.* for the same quantity. But the second machine turns off thirty-three pounds of yarn during the same time that the other is employed in turning off only twenty-eight pounds. The ratio of inferiority is then as 28 : 33.

But 28 lbs. at 4½*d.* the pound gives 126 pence as the earnings made on the first machine during the time which enables the operative on the second to earn 132 pence. Thus the operative gains 6*d.*, and the master 16½*d.*

Improvements in machinery, producing similar effects, are daily and hourly going on in all branches of cotton-working. It having been stated to me by George Murray, Esq., the proprietor of one of the largest fine spinning-mills in Manchester, that "he doubted whether it would be possible to apply such large mules as are now used in fine spinning to coarse spinning, where the motion is more rapid and the weight of the machine greater, but that it was a matter of opinion in which he might be mistaken."—I sent for the machine-maker of one of the largest coarse spinning-mills in Manchester, a workman of the first class, and asked his opinion on Mr. Murray's evidence; his answer was:—(See D. 1, 132, First Report, Factory Commission.)

"I should say, that with the knowledge that mechanics have now-a-days how to reduce friction to a minimum, and with the superior accuracy of their work, a spinner can manage two mules of 600 spindles for coarse spinning with as much ease to himself, and with as much or more rapidity of the machinery, than he did two mules of 300 spindles each ten years ago. I have not seen mules of 600 spindles for coarse work yet fitted up; but I have myself fitted up a pair of mules for my master of 512 spindles each for coarse work, and they answer so well, that I see that I could easily and certainly add 100 spindles to them. Mule-making is improving every day in Manchester."

It thus appears, that mules carrying 500 spindles are already introduced with success for coarse spinning, and that mules carrying

600 spindles will be probably introduced forthwith. In this stage of the progress of improvement the productive power of the machine will be augmented by one-fifth in the course of a few months. When this event takes place the spinner will not be paid at the same rate for work done as he was before; but as that rate will not be diminished in the ratio of one-fifth, the improvement will augment his money earnings for any given number of hours' work. The whole benefit arising from the improvement is divided between the master and the operative. Both the profits of the one and the earnings of the other are simultaneously increased by it.

The foregoing statement must, however, be qualified. Though it is clearly shown that improvements in machinery of the character which I have been describing increase the earnings of the operative, while they augment the profits of the capitalist, yet those who dispute the former conclusion will say that I have selected a particular case to illustrate my position, and omitted an element of importance in stating it,—that the spinner does not appropriate the whole of the surplus 6*d.*; that in consequence of the increased magnitude of his machine he requires additional juvenile aid, the payment for which is at his own private cost, and absorbs a part of his apparent gain.

This objection belongs to a department of the question of which I am treating, of the utmost importance. The effect of improvements in machinery, not merely in superseding the necessity for the employment of the same quantity of adult labour as before, in order to produce a given result, but in substituting one species of human labour for another,—the less skilled for the more skilled, juvenile for adult, female for male,—causes a fresh disturbance in the rate of wages. It is said to lower the rate of earnings of adults by displacing a portion of them, and thus rendering their number superabundant as compared with the demand for their labour. It certainly augments the demand for the labour of children, and increases the rate of their wages.

If any check were given to the cotton manufacture, nay, if its continual expansion shall not prove sufficiently great to re-absorb those adults whom it is continually casting out, then the improvements in machinery might be said to have a tendency to "lower wages;" but hitherto these improvements have materially benefited the operatives, not only by enabling a greater number of persons to enjoy the advantage of the enormous rate of earnings attainable in this important branch of human industry than would otherwise have been the case, but they have enabled "an operative" (speaking in general) to earn a greater sum of money at the end of the week than he would have earned had the state of machinery remained stationary.

Fortunately for the state of society in the cotton district of England the improvements in machinery are gradual, or at any rate brought very gradually into general use. Hence the fall in the price of the manufactured article is gradual, and the extension of the demand for it, arising from the decrease of price, bringing it continually within the range of the means of greater numbers of consumers is likewise gradual, and keeps up the demand for adult labour, and thus counteracts the effect of the improvements of machinery which operate to displace it. Hence no diminution of earnings for adults has thus far arisen.

(To be continued.)

UNDULATING RAILWAY—WAGER OF £1,000.

Sir,—In your "Notes and Notices" of last week, I observe a correspondent suggests that a wager might be laid between Mr. Cheverton and myself, or our friends, on the result of a trial on an undulating line. Individually, I am not in the habit of offering or accepting bets, but if Mr. Cheverton feel inclined to adopt the recommendation of your correspondent, I shall be happy, on the part of my advocates, to enter (through the medium of your Magazine) into an agreement with him—and, if he be similarly inclined, to stake 1,000*l.* on the result of a trial on five or ten miles of road. The stakes to be lodged in a banker's hands. I trust that the memorial which has been presented to the London and Birmingham Railway Directors may induce them and their engineer, Mr. Stephenson, to institute, as I anxiously anticipate, an impartial trial on that line of road, *on their own account;* in which case, if Mr. Cheverton be the winner, he will gain the 1,000*l.* without deductions. Should he prefer betting a greater sum, I shall be happy to submit his offer to those of my friends who may feel inclined to speculate.

The only sum that I, in conjunction with my partner Mr. Stephenson, should feel disposed to win or lose (which may be added to the stakes), would be the expense of a dinner and wine, at the Albion Hotel, Aldersgate-street, for all who have written on the subject, *pro or con*, in the Mechanics' Magazine—your worthy self, Sir, being President.

Yours, very obediently,

RICH. BADNALL.

Manchester, April 7, 1834.

NOTES AND NOTICES.

Sir John Herschell arrived in safety at the Cape of Good Hope on the 16th of January last. The *Athenæum*, which was the first to announce this interesting event to the British public, states that Sir John had landed all his instruments in good order, and was "in hopes that, before *their* summer months are over, he shall have commenced his astronomical observations."

Accident to Mr. Roberts' Steam Carriage.—We regret to state that, yesterday afternoon, as this carriage was proceeding along Oxford-road, Manchester, on another experimental trip, the engine suddenly exploded, when opposite to All Saints' Church. Happily no lives were lost, but one of the engineers was very much scalded, and a passenger in the street was carried from his legs by the force of the steam, and his head coming in contact with a lamp-post, was seriously injured. The front of the shop of Messrs. Barons, druggists, was completely blown away; and the windows of several of the houses and shops in the neighbourhood were much shattered. The carriage was almost destroyed, and its remnants were conveyed back to the manufactory of the owners by four strong cart horses.—*Liverpool Chronicle April* 5. After travelling about a mile and a quarter, it was found that the pumps of the engine did not work with their customary facility, and that the water in the boiler had become rather low. The engine was consequently stopped as early as possible, in order to prevent the possibility of accident from the tubes being overheated; but, as it subsequently appeared, this precaution was not adopted quite in time. The boiler was then directed to be refilled with water, which was supplied from an adjoining pond, and the fire was also re-kindled, After these necessary precautions, Mr. Roberts directed the carriage to be turned, and soon after twelve o'clock it commenced its journey home, carrying from forty to fifty individuals. It proceeded at a fair speed until it arrived near the corner of Rusholme-lane, where some of the boiler's tubes gave way, and the steam having in consequence reached the fire-box, blew part of the grate down to the ground with a loud explosion. The cokes in the grate were immediately scattered with considerable violence, and broke several panes of glass in the shop window of Mr. Baron, Mr. Ridgway, and Mr. Greaves. Mr. Ridgway was injured in his face by a portion of the coke striking him, as also a man and boy, who had been hanging on the back part of the carriage. None of these parties, we are happy to say, sustained any injury worth particular notice; and not one of the persons in or near the carriage was hurt.—*Manchester Times, April* 5.

We are glad to observe a very rapid increase in the number of suburban cemeteries; for, assuredly, to a country in so high a state of civilisation as ours, it is a subject of sore reproach, that the pernicious practice of burying within the walls should have endured so long. Besides the Metropolitan Cemetery, near Westbourne-green, there have been ten others established within the last eight years for different country towns; and Mr. Carden, to whom the honour belongs of having taken the lead in this matter, and persevered in it with a rare spirit of zeal and determination, is now engaged in organising a second Metropolitan Cemetery, to be called "the Great Western," from the site chosen for it being in the vicinity of the Parks and Kensington Gardens. We can hardly imagine a spot better fitted for an establishment of this kind than the ground selected for this new cemetery—indeed, we had no idea there was any thing so suitable within so short a distance of town; it forms part of the western face of Notting-hill, is beautifully undulated, well wooded and watered, and perfectly secluded.

Amidst the nearly universal prevalence of the absurd error, that wages are not subject to the general laws of demand and supply, it is cheering to find an instance, in Glasgow, of the recognition, by the workmen, of the principle that the number of labourers is one of the chief elements in settling the price of labour. By the evidence of a large Glasgow manufacturer, given before a Parliamentary Committee last session, it appears that the spinners in that town have applied part of their funds towards paying the emigration expenses of some of their class, and have in this way got rid of one-eighth of their number.—*Character, Objects and Effects, of Trades' Unions.*

Mr. John Lewthwaite, of Rotherhithe, has proposed to make use of harpoons charged with prussic acid, for the speedier destruction of whales. The Ann Elizabeth, of London, Capt. Kendrew, took out, on her last whaling voyage to the South Seas, half a dozen harpoons constructed on this plan by Mr. Lewthwaite, for the purpose of trial. In a letter which has been received from Capt. Kendrew, he states that he had made one experiment, but that the fish was only "paralysed for a few minutes"—owing, it was presumed, to the poison being in two small a quantity. He had several bottles of highly-concentrated acid with him, however, and meant to try the effect of administering it in larger doses.

J. F. (St. Albans) overlooked, but in our next.

Mr. Rudolph Ackermann, the eminent printseller in the Strand, died on the 30th March last. He was born at Schneeberg, in Saxony, in 1764, and was brought up to the trade of a coach-maker. He came in early life to London, where he pursued for some time the occupation of a carriage-draftsman, which led to an acquaintance with artists, and to his ultimately embarking in the printselling business. For enterprise and liberality, as a publisher, Mr. Ackermann had few equals. He was the first to introduce the art of lithography into this country, and published the first of those splendid Annuals, which have, during the last ten years, furnished so lucrative a source of employment to our artists. We have heard that he was also the inventor of some useful improvements in the art to which he was brought up; or, more properly speaking, of a carriage on a new construction, which did not obtain from the trade that attention which it deserved.

The steam-carriages (Russel's) are now running hourly betwixt Glasgow and Paisley. They have not yet generally made the trips so quickly as we anticipated, which is chiefly to be attributed to the inexperience of the engineers and other causes, though, it is to be hoped, time and practice will fully obviate them.—*Scotsman.* We shall be glad to receive from Mr. Russel, or our correspondent Mr. Whitelaw, some account of these carriages.

An Embryo Engineer seems to have been misled by the title of the "Gallery" he speaks of, which, though styled "National," is altogether a private speculation; he should apply to the proprietors.

We shall be glad to receive a continuation of Brackstone's very useful papers, at his convenience. The *other* branch of inquiry alluded to in his private note is, we think, already sufficiently attended to by other periodicals.

Communications received from M. S.—Mr. Baker—J. H.—S. S.—Mr. Mackinnon.

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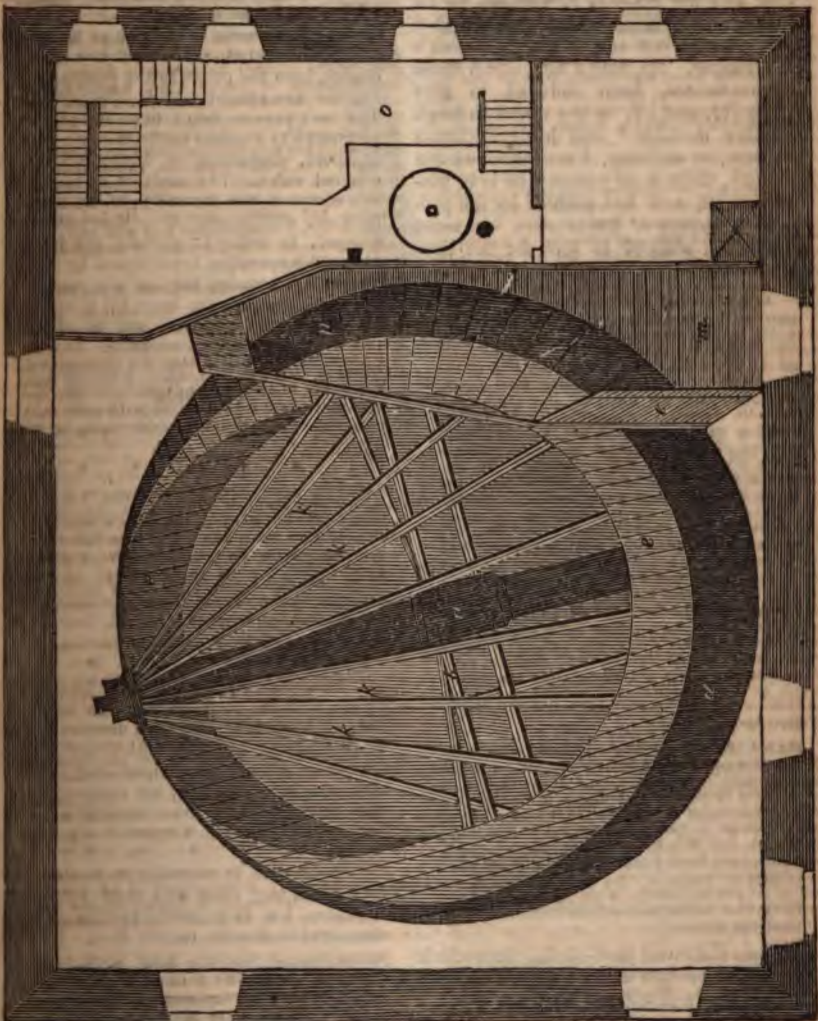
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 558. SATURDAY, APRIL 19, 1834. Price 3*d.*

AUSTRIAN OX-MILL.

Fig. 1.



5 4 3 2 1 0 *Feet.*

Scale of Vienna Fathoms.

THE ART OF BREWING—OX-MILL USED IN THE BREWERIES OF VIENNA.

Of the treatises published under the superintendence of the Useful Knowledge Society, one of the very best was that on the "Art of Brewing," by Mr. David Booth; but owing (we believe) to some misunderstanding between the author and the Society, it was left in an incomplete state—two parts only, instead of four, having received the Society's *imprimatur*. Mr. Booth has, under these circumstances, been induced to give Parts III. and IV. to the world through another medium,* and however much he may, by so doing, have offended the Society, there is no person who is in possession of, and has profited by the preceding portion of his labours, but must feel much obliged to him for the continuation.

The information supplied by these supplementary Parts is all of a very useful and necessary description, and much of it perfectly new to the British public. Part III. contains chapters on the quantity of fermentable matter obtainable from a given weight of malted barley, and the proportion which it bears to the specific gravity of the worts—on the different methods of procuring fermentable extracts—on the cooling of worts—on the several modes of fermenting worts—and on the strength of fermented liquors—with a table, showing the pounds of dry extract in a hundred gallons of any wort, corresponding to its gravity. Part IV. is appropriated to brewing in foreign countries, and treats of the art as practised at Munich, Prague, Vienna, Berlin, Brussels, Louvaine, &c. Mr. Booth states, that "for the greater portion of the information in this chapter he is indebted to the manuscript and oral communications of two German brewers (from Vienna and Munich), who have been, and now are, visiting the principal towns of Europe, for the laudable purpose of acquiring information concerning their business."

From the latter part—being that which contains the most novel information—we shall make a few extracts.

And first as to the *Bavarian beer*, which, when in prime condition, is "as bright as wine, and contains so much carbonic acid, that it is in that respect similar to champagne."

"The beer throughout all Bavaria is nearly of the same strength; usually between $3\frac{1}{4}$ and $3\frac{1}{2}$ barrels to a quarter of malt. It is made wholly from malted barley and hops; and all sold at an uniform rate, which is fixed by law, every year, according to the price of barley; so that there is but one kind of malt-liquor for all classes, from the prince to the peasant. The rate for the present year is 16*s.* per barrel. The beer pays no duty; but the malt must be ground at a public mill, where an impost is levied, amounting to about half of its original value. The malt is screened before carrying it to the mill; and being generally cut with stones, it is also previously damped, in order to prevent the loss by dust. This operation is performed by sprinkling with a watering pan, at the same time frequently turning the heap till it has been well mixed with about two gallons of water to the quarter; and then leaving it to soak for nine or ten hours, that the moisture may penetrate to the centre of each grain. When the malt is to be bruised with rollers, this damping is not considered necessary."—p. 25.

* * * * *

"The cellars in Munich are very deep under ground, so that the temperature never rises higher than between 7° and 8° of Reamur, which is from 48° to 50° of Fahrenheit. In some of them ice is preserved through the summer. It is within such cellars that the beer is cleansed, into casks that lie on their side, bung uppermost.

* * * * *

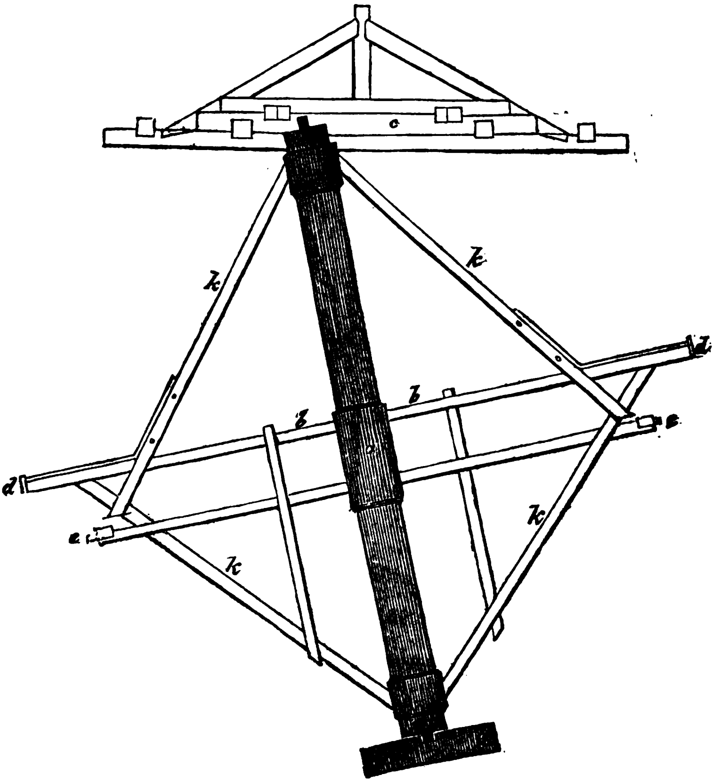
"After the beer has thus lain from eight to ten months, it is reckoned to be fit for use; and for that end it is drawn off into small casks as wanted, which are immediately carried out to the publican, and on the same day drank by his customers: so that every publican must be supplied with beer every day from the brewery."—pp. 27, 28.

* * * * *

"Great care is requisite in having the store-casks very clean and *sweet* before filling them, lest they should communicate a disagreeable flavour to the beer. In two towns this is effected, after they are well washed, by smoking them with burning sulphur; but in the rest of Bavaria it is done by lining them with pitch. The following is the manner by which this is effected at Munich:—The store-casks, in which the beer is cleansed, are previously *pitched* every time for summer-beer, and once a year for winter beer. Pitching is

* The Art of Brewing. Parts III. and IV. By David Booth. To which is added, an Appendix concerning Burton Ale. London: F. J. Mason. 8vo. 1834. pp. 56.

Fig. 2.



practised in this way—one end of the cask is taken out, and two English pounds of pitch for every barrel of its contents, if the pitching has only to be renewed (but double that quantity if for the first time), is set fire to on the bottom of the cask, and made to burn until the whole has become perfectly fluid. This being done, the fire is extinguished, by putting in the head of the cask, and driving the hoops close; and then the cask is rolled about and turned in every direction, so that the pitch may be spread over every part of the inner surface, which it will thereby cover with a crust of one-eighth of an inch thick. This crust is apt to crack and blister, which causes the necessity of re-pitching every season. The professed object of this manipulation is cleanliness; but it doubtless communicates a peculiar flavour to the beer, which, however, is liked, and consequently required, by the customers *of those brewers.*"—*p. 29.*

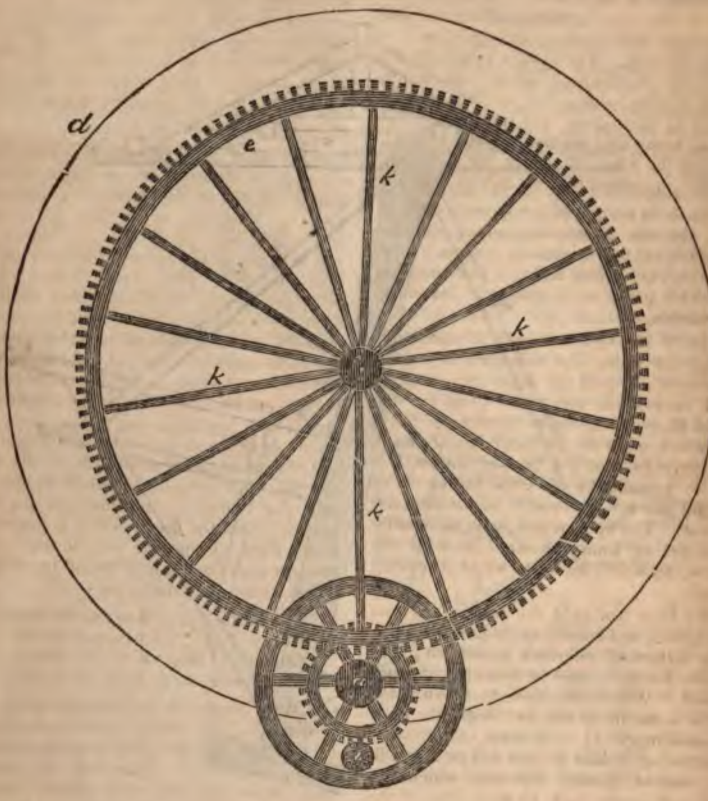
* * * * *

"The brewers of this city (Augsburg) wash their coolers with great care, scrubbing them every week with Dutch rushes—the stalks of the *equisetum hyemale*; but, notwithstanding this apparent regard to cleanliness, they have one practice which we, in this country, should not venture to imitate. Like the rest of their countrymen, they pitch their store-vats; but instead of waiting until the plaster is cold, they cleanse the fermented worts into the vats while the pitch is smoking and burning hot. It is this which gives the peculiar flavour by which the Augsburg beer is distinguished from that of all the rest of Bavaria."—p. 31.

The beer next in continental repute to the Bavarian is that of Prague.

"The city of Prague has been famed for

Fig. 3.



its breweries from time immemorial. These constitute the chief support of a great proportion of its inhabitants; and the beer, next to that of Bavaria, is accounted to be the best in Germany. The mode of brewing is very similar to that which is practised at Munich. The brewers in the city draw one hundred gallons of beer from the quarter of malt, while those of the suburbs make ten to twelve gallons more; and, notwithstanding, the beer of the latter has a more agreeable taste than that of the former."—p. 31.

* * * * *

"The beer-vaults of Prague, of which every publican has one, are of the very best kind. The floor of each is covered with a deep mass of ice, which never melts; and upon this mass the beer is placed, when received from the brewer. After it has lain from four to six weeks on its icy bed, it is fit for drinking, and is served out to the customers in that chilly state."—p. 33.

In treating of the method of brewing at Vienna, Mr. Booth gives the following description of a species of tread-mill, by means of which oxen are employed to drive the mill-stones and rollers (for bruising the malt), which though "little, if at all, known in this country," he thinks deserving of more extensive publicity, "believing that it would prove a cheap and convenient power in certain situations." We copy also, by permission of Mr. Booth, the engravings to which the description refers:—

"Fig. 2 is a section, showing the position of the tread-wheel *d d*, with respect to its angle of elevation as compared with the horizontal portion of the roof *p p*. The shaft *a*, at right angles, and fixed to the tread-wheel, turns on pivots at the top and bottom, which are inserted into strong tim-

ber-work. The cog-wheel *c c* parallel to the tread-wheel *d d*, and also fixed through its centre to the shaft *a*, communicates its motion to such other parts of the machinery as may be required. The wooden spurs *k k k k* sustain the tread-wheel, above and below, uniting a little above the cog-wheel, and fastened at their ends into the shaft. The rim *d d*, being that portion of the circumference of the wheel on which the ox treads, is further supported by the timbers *b b*.

"Fig. 3 is a view of the cog-wheel from above, showing its communication with the other parts of the machinery; such as the fly-wheel *f*, the crank *h*, &c. The spurs *k k*, &c., which preserve it steady in its place, are also seen.

"Fig. 1 is a ground-plan of the whole building in which the tread-wheel stands. It is very high, and the main shaft is sunk in an excavation five feet deep in the ground-floor. The same letters of reference which mark the parts of figs. 2 and 3, also apply to this. A bar of boards, *l*, is fixed to prevent the ox from falling down into the pit below, should he accidentally get loose. The wooden gangway, *m*, enables him to get up from the stall below to the stage *n*, on which he walks without moving forward.

"We have abridged the description from the original, and consequently have left some of the letters of reference unnoticed; but we have doubtless said sufficient to be understood. When much power is wanted, the mill is sometimes supplied with three or four oxen together, in a team. The scale affixed to fig. 1, also applies to figs. 2 and 3. It is one of Vienna fathoms, which are something larger than English, 100 of the former making nearly 104 of the latter."—pp. 38-41.

It will, doubtless, be in the recollection of our readers, that the Burton ale-brewers, moved by what was said of their peculiar modes of practice in the Second Part of this work of Mr. Booth's, applied to the Court of King's Bench for leave to file a criminal information against the publishers of the Useful Knowledge Society; and that, in consequence of Mr. (now Lord Chancellor) Brougham's afterwards stating to the Court, on the part of the Society, that they had, after due inquiry, satisfied themselves that there was no ground for imputing to the plaintiffs the use of any thing, save malt, hops, and water, in the manufacture of their beer, the rule to show cause was discharged. It appears, however, from the extract which follows, that Mr. Booth himself (incredible as it may seem) "was never consulted" with respect to these proceedings; and that had he been consulted, as he ought to have been, the records of the court might possibly have told a very different tale:—

"On referring to Chapter X., Part II., of the Art of Brewing, which treats of Burton ale, it will be seen, that, in recommending the adoption of certain ingredients, the writer was careful not to impute the use of them to the licensed brewers: he well knew, that, for them, every article, except malt and hops, was illegal, and subjected them to severe penalties. But the question arose, how much was insinuated, and how far such a suspicion might raise a prejudice against their beer—a circumstance directly opposite to the intentions of the author.

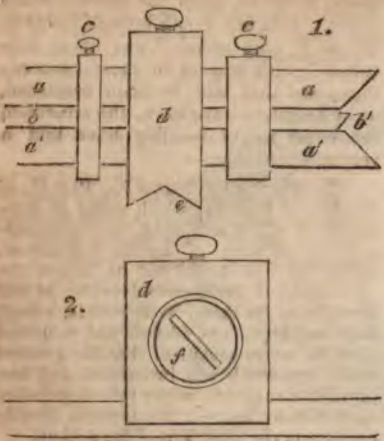
"One of the affidavits, gratuitously, acknowledged the occasional use of flour and salt, to assist the fermentation of the inferior ale; and the jalap, of which it only was said that 'some recommend' for the same purpose (and the use of which is doubted at p. 28, Part I.), may as well be left out of the supposed-accusatory list of ingredients. These, then, are reduced to,

Salt of steel	2 oz. to 20 barrels.
Honey	1 lb. per barrel.
Sulphate of lime .	6 oz. per barrel.
Black rosin	1 oz. per barrel.

"With respect to the proceedings in this prosecution, the writer of the alleged libel, though his character was in some degree at stake, *was never consulted*. It appears, from what followed, that several chemists were employed to analyse the ale, as well as the water of which it was made, and, had he known of their appointment, he would have told those scientific gentlemen, that the honey and rosin (granting that they had even been introduced) *would certainly escape their detection*; that the salt of steel, not being by weight one part in sixty thousand, would possibly be too minute for discovery; and that the sulphate of lime alone would probably be found. The result would have justified the prediction."—pp. 52, 53.

UNIVERSAL TOOL FOR CUTTING OUTSIDE SCREWS.

Sir,—Every turner recollects how, when he was a beginner, the chisel would sometimes, when held improperly, be caught by the work, and forced to one side, so as to make a screw-like cut



on the wood. The accident seems to suggest the plan of an universal tool for cutting outside screws on wood, and I think on metal too. The above figures represent my idea of such a tool. Fig. 1 is a side view. *a* and *a'* are two chisels, like carpenters' chisels; but having their edges ground off to an angle of 45° with the line of their length. *b*, *b'* is the cutting tool so formed, that its point may be made to occupy the vertex of the right angle included by the edges of *a* and *a'*. *c* and *c'* are clamps for keeping the other parts together. *d* is a block, having at *e* a groove in it; this block allows the cutting tool to pass through it, and the groove slides on a rest. Fig. 2 is a side view of the block; another circular block works in it, and allows the cutting tool to pass through it, as seen in section at *f*; this inner block can be fixed in any position, by means of a thumb-screw seen in figure. The chisels and the cutter must be so adjusted, that the point of the latter, being a little in advance of the edges of the former, shall lie in the plane passing through those edges: the inner block is to be adjusted, so as to cause the cutting tool to make any desired angle with the work, and the whole is ready for use. This tool seems to be universal, because the shape and size of the cutter determine the depth and form of the thread, and the angle, at which the tool is fixed by the inner block, determines the rapidity of the screw. φ. μ.

MORTALITY IN VARIOUS COUNTRIES OF EUROPE.

There annually dies 1 inhabitant in 28 in the Roman state and the ancient Venetian provinces; 1 in 30 in Italy in general, Greece, and Turkey; 1 in 39 in the Netherlands, France, and Prussia; 1 in 40 in Switzerland, the Austrian empire, Portugal, and Spain; 1 in 44 in European Russia and Poland; 1 in 45 in Germany, Denmark, and Sweden; 1 in 48 in Norway; 1 in 53 in Iceland; 1 in 58 in England; 1 in 59 in Scotland and Ireland.

These numbers present the following results:—

The smallest chances of life, and its shortest duration, are not, as one might believe, amongst the effects of the rigorous climate of Norway, or the marshy soil of Ireland; it is in the beautiful climate of Italy that life is reduced to its minimum extent. On the contrary, it is among the icy rocks of Iceland, in the midst of the eternal mists of Scotland, where man attains his greatest age.

Two great causes predominate over all others, determining the ratio of mortality to the population; or, in other words, regulating the number of the chances of human life: these are the influence of climate and civilisation.

The smallest mortality in Europe occurs in maritime countries which are in the vicinity of the polar circle. Countries where the heat is moderate, are not, as might be supposed, among those which possess the advantage of a small mortality; to obtain it, they must acquire the benefits of a high state of social order.

The southern countries, the mild climate of which seems to be so favourable to the human race, are, on the contrary, regions where life is exposed to the greatest dangers. In the smiling plains of Italy the chances of dying are one-half greater than those of cold and misty Scotland; and under the beautifully serene skies of Greece the certainty of life is one-half less than among the glaciers of Iceland.

The ameliorations consequent on progressive civilisation may be appreciated in a convincing manner, by inquiring what has been their influence on mor-

tality, during the last century, in the three European countries where their progress has been most obvious. If we collect England, Germany, and France, in one group, we find that the average term of mortality which, in that great and populous region, was formerly 1 in 30 people annually, is not, at present, more than 1 in 38. This difference reduces the number of deaths throughout these countries from 1,900,000 to less than 1,200,000 persons; and 700,000 lives, or 1 in 83, owe their preservation to the social ameliorations effected in the three countries of western Europe, whose efforts to obtain this object have been attended with the greatest success.

The life of man is thus not only embellished in its course by the advancement of civilisation, but is even extended by it, and rendered less doubtful. The effects of the amelioration of the social condition are to restrain and diminish, in proportion to the population, the annual number of births, and in a still greater degree that of deaths; on the contrary, a great number of births, equalled or even exceeded by that of deaths, is a characteristic sign of a state of barbarism. In the former case, as men in a mass reach the plenitude of their physical and social development, the population is strong, intelligent, and manly; whilst it remains in perpetual infancy where generations are swept off without being able to profit by the past, to bring social economy to perfection.*

A.

April 2.

EFFECTS OF IMPROVEMENTS OF MACHINERY ON WAGES, AS EXEMPLIFIED IN THE COTTON MANUFACTURE. BY JOHN W. COWELL, ESQ.

(*Concluded from page* 31.)

To display the effects which improvements in machinery actually produce on the price of labour, both adult and juvenile, and and how they produce them, I will exhibit the analysis of the *personel* of three mills, in the shape necessary for the purpose.

The mills in question are all "fine-spinning" mills in Manchester, spinning yarn of the quality of 110 up to 210 hanks to the pound. The number of operatives which they employed in May 1833 is shown, and is divided into adults and non-adults of the two sexes. The productive power of the spinning-machines (mules) was respectively 336, 324, and 312, and each mill was then preparing to double the mules, *i. e.* to double their productive power. It is to be borne in mind that the spinner always manages two mules.

The deductions of adult hands and the additions of juvenile ones are based upon the following calculations. I instance them only from the mill (A), the process being the same with respect to mills (B) and (C).

In mill (A) twenty-five men work twenty-five pair of mules of 336 spindles each mule; this makes the total number of spindles 16,800, and the men are assisted by eighty-eight boys and twenty-four girls as piecers of the threads. Now the spinner himself, spinning the quality of work executed in these three mills, can only attend, upon an average, to the piecing up 48 threads on each of his mules,* which gives 96 threads as his share for the pair of mules, and this, for twenty-five spinners, gives a total of 2,400 threads out of the 16,800 to which the spinners can attend. This leaves 14,400 threads to be attended to by 112 piecers (boys and girls), which gives 128 as the average number of threads attended to by each piecer in mill (A).

Now the spinner, having to attend to the entire guidance of the mule, cannot look after more threads on a *large* mule than he can on a *small* one; and when the number of mules in mill (A) shall be reduced from twenty-five pair to thirteen, he will still be unable to look after more than 96 threads; and as the number of spinners will be reduced to thirteen, so the whole number of threads which the whole number of spinners will then be able to piece up will be 1,248 (instead of 2,400), this will leave 15,552 threads to be pieced up by the piecers; hence 121 piecers will be required (instead of 112 as previously), if the same average of threads per piecer is still taken. In point of fact, however, the same average ought not to be taken, as the more convenient form which the mule will assume will enable the piecers (though it will not the spinners) to look after a greater number of threads than before, and hence so many as nine piecers need not be added to the number previously employed.

Assuming therefore such proportions, and applying them to all the three mills, each proportion calculated for each mill respectively, the total number of adults dismissed will be seventy-five, and that of juvenile hands who supersede them will be fifty-seven.

* From a paper in Jameson's Edinburgh Philosophical Journal.

* I state this upon the authority of the overlooker of one of these mills, whom I repeatedly examined on the point.

Mill (A), possessing twenty-five pair of mules of the productive power of 336 spindles each mule, and spinning yarn of the fineness of 170 to 210 hanks to the pound, with the following *personel*:—

	Men.	Women.	Boys.	Girls.
Manager	1	..	..	..
Clerk	..	..	1	..
Picking-master	1	..	..	..
Pickers and batters	..	20	..	..
Engineers	1	..	..	..
Carder	1	..	..	..
Card-grinders	2	..	..	..
Top-card strippers	2	..	..	..
Drawing-frame tenters	..	6	..	..
Skellet-tenters	..	1	..	1
Slubbers	1	..	..	..
Stretchers	..	3	..	..
Back-tenters	..	..	..	4
Roving sorter	..	1	..	..
Wrapper	..	1	..	..
SPINNERS	25	..	..	..
PIECERS	..	..	88	24
Watchman	..	..	..	..
Mechanic occasionally	1	..	..	..
Totals in May 1833	36	32	89	29
The twenty-five pair of mules were to be made into thirteen pair of 636 spindles each mule, when twelve of the 25 adult spinners will be dismissed and nine additional piecers employed	—12		+9	
The *personel* will then be	24	32	98	29

Mill (B), possessing twenty pair of mules of the productive power of 324 spindles each mule, and spinning yarn of the fineness of 120 to 210 hanks to the pound, with the following *personel*:—

	Men.	Women.	Boys.	Girls.
Clerk	1	..	..	..
Machine-tenter	1	..	..	..
Cotton-pickers	..	8	..	..
Carder	1	..	..	..
Spreader	..	..	3	..
Card-grinder	1	..	..	..
Top-card strippers	3	..	..	..
Card-tenters	..	..	2	..
Card-brushers and cylinder-stripper	1	..	..	..
Drawing-frame tenter	..	6	..	..
Roving-frame tenter	..	1	..	..
Jack-tenter	..	1	..	..
Stretchers	3	..	..	..
Back-tenters	..	3	..	2
Roving sorter	..	1	..	..
SPINNERS	20	..	..	..
PIECERS	..	..	63	17
Reelers and wrapper	..	4	..	..
Engineer	1	..	..	..
Mechanic occasionally	1	..	..	..
Totals in May 1833	33	24	68	19
The twenty pair of mules were to be made into ten of 648 spindles each mule, when ten adult spinners will be dismissed, and seven additional piecers employed.	—10		+7	
And the *personel* will stand thus	23	24	75	19

Mill (C), possessing 103 pair of mules of the productive power of 312 spindles each mule, and spinning yarn of the fineness of 140 to 210 hanks to the pound, with the following *personel*:—

	Men.	Women.	Boys.	Girls.
Manager	1	..	..	..
Clerk	1	..	..	..
Taker in from spinners and reelers	1	..	..	..
Picking-master	2	..	..	..
Pickers	..	90	..	..
Head carder	1	..	..	..
Assistant carders	2	..	..	..
Card-grinder	4	..	..	..
Cylinder-stripper	2	..	..	..
Top-card stripper	12	..	..	..
Spreaders	..	..	14	..
Card-tenters	..	..	13	..
Bushers, &c.	3	..	..	..
Drawing-frame tenters	..	..	..	..
Jack-frame tenters	..	14	..	..
Stretchers	..	13	..	..
Back-tenters	..	..	..	14
Roving sorter	..	3	..	..
Overlookers	2	..	..	..
SPINNERS	103	..	..	..
PIECERS	..	..	306	97
Wrapper	..	1	..	..
Reelers	..	15	..	..
Yarn examiners	1	..	..	..
Makers up, &c.	..	..	3	..
Mechanics	6	..	..	..
Watchman	1	..	..	..
Engineer	1	..	..	..
Fireman	1	..	..	..
Roller coverers	2	..	..	..
Lodge-tenter and strap-mender	1	..	..	..
Totals in May 1833	147	164	336	111
The 103 pair of mules were to be made into fifty pair of 648 spindles each mule, when fifty-three adult spinners would be dismissed, and forty-one additional piecers employed	—53		+41	
And the *personel* will stand thus	94	164	377	111

I have explained the grounds on which I have deducted seventy-five adults, and added fifty-seven non-adults, after the improvement. Now, though I might fairly estimate the average earnings of a "fine" spinner (which they all are in these three mills) on mules of 336 spindles at 35*s*. net the week, yet I will only take them at 25*s*. Then the total amount of saving in adult labour by superseding seventy-five spinners will be 93*l*. 15*s*. 10*d*. a week, and the additional cost for the albour of fifty-seven additional piecers will be (if they are averaged at 5*s*. each for the week) 14*l*. 5*s*.

But in this case the earnings of each of the remaining spinners will be increased, as is evidenced by the printed list of prices for spinning, which shows that the price paid for work done diminishes in a ratio less rapid than that in which the productiveness of the mule increases: and as the process by which this is effected creates an additional demand for children, the average of their wages must have a tendency to rise; and since the article produced can be offered in the market of the world at a lower price in consequence of the diminution in cost of production, which results from the large saving in wages of labour produced by the improvement of the machine, it is then brought, *for the first time*, within the range of the means of a large class of consumers who never used it before. This must create a demand for a greater quantity of it, enlarge the field of production,

and cause a speedy re-absorption of the seventy-five adults who have been superseded, and who then benefit by the enhanced rate of earnings, produced by the very improvement which primarily caused their displacement, and there then ensues a *new* and *additional* demand for children to assist *them*.

As this process is always going on, as new mills are constantly being built, and old ones enlarged and improved, so the displacement of adults by the introduction of new inventions in machinery never becomes sensible, and the cotton-working population has swollen to a magnitude second only to that of the agricultural.

So far with regard to the general effect on wages produced by the improvement. Now with regard to the objection that the spinner does not appropriate the whole of the benefit which at first sight appears to fall entirely to his share. I admit that the objection which has led to my discussing this point is grounded on fact; I admit, in the case which I selected to show that the spinner would receive 6*d*. more from spinning on mules of the power of 396 instead of 336, that he will not appropriate the whole of the 6*d*.; but I assert that his net earnings will still be much increased by the improvement.

In the cases of the three mills, A, B, and C, which I have taken, there were 148 spinners, who employed and paid 595 piecers. The improvements displace seventy-five of the spinners, and the remaining seventy-three have not only to pay, out of their receipts for work done, the wages of the 595 piecers (previously paid by the whole 148), but likewise of forty-one additional piecers, which will amount to the sum of 14*l*. 5*s*. I admit that this amount of 14*l*. 5*s*., as well as that the whole amount of the wages of the 595 piecers, will be thrown entirely on the earnings of the remaining seventy-three spinners; but I assert that the net earnings of every one of those seventy-three spinners will nevertheless be greater for any given number of hours' work, after the improvement than it was before it.

In the year 1833, in two fine spinning-mills at Manchester, which I need not name, and while I was in the town, a spinner could produce sixteen pounds of yarn of the fineness of 200 hanks to the pound from mules of the productive fertility of 300 to 324, working them sixty-nine hours; and the quantity that he turned off in sixty-nine hours more frequently exceeded sixteen pounds than fell short of it.

These very mules were being replaced by others of double power while I was at Manchester. Let us examine the effect on the spinner's earnings:—In the early part of last year he produced sixteen pounds of yarn of No. 200 from mules of the power of 300 to 324 spindles. Consulting the list of prices, I perceive that in May he was paid 3*s*. 6*d*. a pound; this gives 54*s*. for his gross receipts, out of which he had to pay (I will put the amount high) 13*s*. for assistants. This leaves him with 41*s*. earnings. His mules have their productive fertility doubled. They are converted into ones of the power of 648. He is now paid 2*s*. 5*d*. a pound instead of 3*s*. 6*d*. But he produces thirty-two pounds of yarn of the fineness of 200 hanks to the pound in sixty-nine hours. His gross receipts are immediately raised to 77*s*. 4*d*. I will now admit that he requires *five* assistants to help him, and, averaging their cost at 5*s*. a piece, their labour will cost him 25*s*., and, to avoid all cavil, I will add 2*s*. extra. Then deducting 27*s*. from his gross receipts, there remains a sum of 50*s*. 4*d*. for his net earnings for sixty-nine hours' work, instead of 41*s*.*

Therefore reverting back to the three mills, A, B, C, I mean to say that, after the change in the machinery shall have displaced seventy-five spinners, each of the remaining seventy-three will be gaining at the rate of 50*s*. and upwards, instead of gaining at the rate of 40*s*. and upwards, for equal times, and for similar qualities of work, though he then will have to pay more than double the number of assistants that he previously paid; and hence it must likewise be obvious, that when I stated the actual net earnings of a spinner at no more than 1*l*. 5*s*. for sixty-nine hours' work, I was greatly within the mark. I know that when I was in Manchester the net earnings of a spinner in the three mills in question, with the machinery in its then state, varied from 32*s*. to 43*s*. for sixty-nine hours' work, according to the work which they might be executing at the moment, as that might vary between the extremes of "yarn of the

* While this paper has been going through the press, I have received the history *in detail* of every week's work of a pair of mules, spinning No. 200, and carrying 360 spindles each mule; and this pair of mules turned off between Christmas-day 1832 and Christmas-day 1833, 1,065 lbs. 8½ oz. of yarn of the fineness of No. 197 hanks to the pound; and during the year the mill in which the mules are situated lost fifteen days' work, of eleven hours and a half each day, by holydays and stoppages of the engine. Nevertheless the average weight turned off in a week is 20.49 lbs. This document enables me to give the quantity of No. 200 which a pair of mules of 300 spindles would turn off in a week, working eleven hours and a half each day, and it is 16.46 lbs. Consequently, in the proof which I have tendered above, to show that "the earnings of a spinner spinning yarn of the fineness of 200 hanks to the pound, on mules of the productive power of 300 to 324, will be augmented in the ratio of forty to fifty, by an improvement which raises the productive power of his mule to 648," I have been under the mark as to the amount of his earnings. They will be greater than I have stated them to be.

fineness of 120 hanks" and "that of 210 hanks" to the pound.

A large portion of those discrepancies exhibited by the tables in the rate of net earnings realised by an operative for sixty-nine hours' work (comparing mills performing the same kind of work) is to be accounted for by the different proportions which the respective qualities of their machinery enable the various owners to establish between the numbers of the skilled and those of the unskilled operatives whom they employ; and had I been afforded the time and means of compiling a second set of tables from the returns to the Lancashire form of inquiry, it would exhibit the ratio which juvenile bears to adult labour in the leading departments of each mill, and have contained the average earnings of an operative of each class, as to age and sex, for sixty-nine hours' work. The result, I have no doubt, would have shown in detail that the earnings of the adults were the largest in mills where the ratio of the number of children to the number of adults was the highest; and that as long as the cotton-working business continues to extend, the apprehensions entertained by the operatives of a fall in wages either for adults or children, consequent upon improvements in machinery, are groundless. Their assertion is (and it was repeated to me innumerable times), that they have to turn out more work now for less wages than formerly. The *Manchester and Salford Advertiser*, which is the journal of the operatives, scarcely publishes a number which does not ring the changes on this assertion, and in that for the 11th of January, it asserts "that a spinner now turns out double the work for a tenth less wages than in 1804."

The matter stands thus:—In 1804 a spinner was paid 8*s*. 6*d*. for every pound of yarn of the fineness of 200 hanks to the pound, spinning on a mule of the average productive power at that time. What that productive power was I do not know. But in 1829 he was paid at the rate of 4*s*. 1*d*. for spinning the same quality on a mule of the productive power of 312; in 1831, and at present, at the rates of 2*s*. 5*d*. and 2*s*. 8½*d*. for spinning the same quality on a mule of the productive power of 648. These quotations are from the Manchester prices.

Thus in 1829 the spinner turned off 312 pounds of yarn in the same time that he now takes to turn off 648. He was paid at the rate of 4*s*. 1*d*. per lb. in 1829; he is now paid at the rate of 2*s*. 5*d*. But 312 lbs. at 4*s*. 1*d*. amount to 1,274 shillings, and 648 lbs. at 2*s*. 5*d*. to 1,566 shillings. He receives, therefore, 292 shillings more than he did in 1829 for equal times of work. It is perfectly true that he does "more work for less wages than in 1829;" but this is nothing to the purpose, when the proposition to be proved is, that "wages are lower than formerly." I mean to say that a spinner earns a shilling, or a pound, or an hundred pounds, in less time at present than he would have consumed in earning a shilling, or a pound, or an hundred pounds, ten years ago, and with the same or less labour; that this enhancement of his earnings has been owing to improvements in machinery; that the progress of improvements will progressively advance his earnings still higher, and at the same time enable a greater number of individuals to profit by the enhanced rate than actually profits by the actual rate (provided that nothing occurs to prevent the cotton business from developing itself for the next thirty years as it has done for the last); and that any improvement in the machinery in any one of the numerous departments of cotton-working will operate to enhance the rate of wages in all other branches (as well as in that department in which it takes place), by increasing the actual previous demand for labour in those other branches. I assert that every improvement of cotton machinery, in any department of cotton-working, has hitherto had the effect of enabling "an operative" (speaking in general of every one, in every department whatever) to earn a greater net amount of money, in any given time, than he would have done had the improvement never taken place.

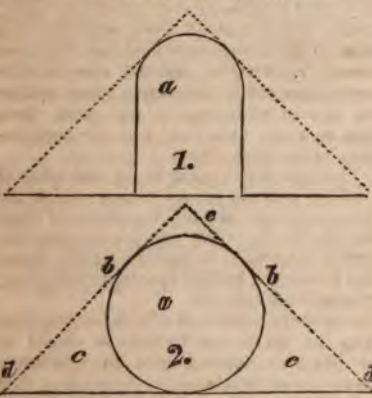
The misconceptions as to the real effect of machinery on the price of labour which the operatives entertain are the causes of turn-outs and strikes; they produce rankling discontent towards their masters; and I regret that I have not had the opportunity of giving them a fuller exposure.

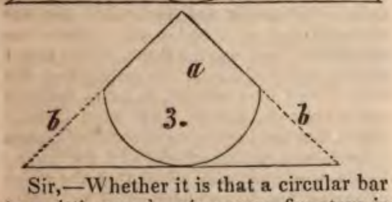
I certainly consider it of great consequence that the operatives themselves should be satisfied that improvements in machinery tend to raise the amount of money that they gain, individually and generally, for the same number of hours' work. Those who dispute the fact must, I think, admit that I have established it in the instance of the three mills I have selected, as far as spinners are concerned; and as they must likewise admit that the improvement specified creates a fresh and additional demand for young hands, they must also admit that the wages of young hands are augmented in consequence. They must equally admit that, as the price of the article will be lowered in the market, from the effects of the improvement, more of it will be consumed; and hence that in all the conclete processes connected with spinning of cotton, more hands will be required, and consequently that wages throughout the whole range of cotton-working will be better than they were before. If these considerations should induce operatives to

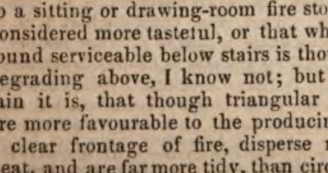
hesitate before they combine and turn-out against new machinery—before they require a bill for shortening the hours of work, in order to counteract the (fancied) injurious effect upon wages of improvements in machinery, and lead them to neglect the instances of those who wish them "to strike for eight hours' work and twelve hours' earnings," (and this is the advice they have lately received) my purpose will be answered.

The generality of the operatives in cotton-working are well-meaning, respectable, shrewd, and sensible; and I believe that if the real effect of machinery in augmenting the actual rate of their earnings, and enabling a greater number of persons to benefit by the augmented rate, could be fairly set before them, and rendered familiar to their minds, it would have a most beneficial effect on their actions as members of society.

ALTERATION IN THE SHAPE OF GRATE-BARS, TO PRODUCE A FREER DRAUGHT, AND CLEARER FRONTAGE OF FIRE.







Sir,—Whether it is that a circular bar to a sitting or drawing-room fire stove is considered more tasteful, or that what is found serviceable below stairs is thought degrading above, I know not; but certain it is, that though triangular bars are more favourable to the producing of a clear frontage of fire, disperse more heat, and are far more tidy, than circular ones, and are quite as capable, too, of a high *polish*, they have never yet found their way into high life. The member of the kitchen *bar* have of late begun to assume (like many other servants now-a-days) the appearance of their more honoured tribes, but with manifest detriment to their real service and utility.

I beg to propose, as an improvement, the use of angular bars, in the better sort of stoves, and that the inner sides should be rounded, as in fig. 3, which would serve to keep back the coals, and, I think, give more effect to the draught, as well as be more sightly, than if the bars were made quite square. The angular shape, also, will prevent the accumulation of dust and ashes upon them.

In the prefixed figures, the three shapes are shown, and it will be readily perceived that figs. 1 and 2 have a much larger space between the bar and the line of draught than in fig. 3. This space is generally dull, if the coals touch the bar, and consequently less heat is discharged. Besides, the front of each of the bars, figs. 1 and 2 has a tendency to repel the approaching current of air, checking its free ingress, causing that to pass up the chimney which would otherwise pass through the fuel.

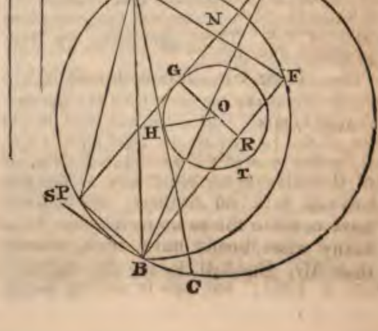
In the figures, *a* represents the bar, *b* the line of draught, *c* the space between the bar and the line of draught, *d* the dull space of the fire front, *e* space where the check to the draught is occasioned.

JAS. WOODHOUSE.

Kilburn, March 4, 1834.

SOLUTION OF IVER MACIVER'S PROBLEM (last vol., page 443), BY A LADY.

Problem.—To inscribe a quadrilateral in a given circle, having given each of the diagonals and area.



Place the two given diagonals A B, A C, in the given circle A B C, and let the square of D be the space which the required quadrilateral is to be equal. Find L a third proportional to A C and D, and upon A B describe the semicircle A E B, in which apply the chord A E double L. Join E B, and from the centre O of the given circle describe the circle G H T, touching A C in H. Draw G T parallel to A E, meeting the circle G H T in G, and B E in R; and through G draw the chord P K, touching the circle in G. Join A K, B K, B P, A P, then shall A K B P be the quadrilateral required.

Draw B S at right angles to K P; because the straight lines A C and P K are equally distant from the centre $\therefore$ P K $=$ A C. Also since the angles at G and E are right angles, and G R parallel to A E $\therefore$ G N E K is a rectangle, and the angle at S being also a right angle $\therefore$ S B E N is a rectangle, and B S $=$ N E. Now the area of the quadrilateral A K B P $= PK\left(\frac{AN+BS}{2}\right) = \frac{PK.AE}{2} = PK.L$ $= AC.L$; but by construction A C : D :: D : L $\therefore AC.L = D^2$. Hence $PK\left(\frac{AN+BS}{2}\right) = D^2$.

The ingenious proposer tells us, that the area is a maximum when it is equal to half the rectangle contained by the two diagonals, or when the two diagonals cut one another at right angles. This may be easily shown to be true from the above construction; but the area will evidently be a maximum when the diagonals cut one another at right angles, whether the figure can be inscribed in a circle or not. It might also be easily shown, from the construction, that as the area diminishes the point P will move nearer and nearer to B; and when the area becomes a minimum, the quadrilateral merges into a triangle $\therefore$ the problem does not admit of a minimum.

I am, Sir, yours respectfully,

M. S.

April 7, 1834.

P. S.—I have watched the progress of the discussion upon the undulating railway with no ordinary interest, and have come to the same conclusion which many wiser heads have done, namely, that Mr. Badnall is in the right. I think if Mr. Cheverton will re-consider what he has stated in his last communication (No. 555, page 433), and also pay a little more attention to the true laws of friction, he will find that what Mr. Badnall has asserted in No. 544, page 244, could easily be done without the aid of miracles. Mr. Badnall, however, will do well (and he has it easily in his power) to put this important part of the question to rest. It will have the double effect of proving that Mr. Cheverton's ideas of friction are equally erroneous with his ideas of atmospheric resistance. I have attempted, and I believe succeeded, in making out a solution of Kinclaven's last question.

M. S.

AUBER'S CHINA.*

The Secretary to the East India Company has recently furnished the public with a volume, on that always mysterious, and now more than ever interesting, subject, the Celestial Empire. Its contents, however, are not exactly of a nature to fulfil the expectation excited by its very comprehensive title; or to satisfy those thirsters after information who may have looked forward to the appearance of such a demi-official work as likely, considering the exclusive stores of intelligence, which we may naturally suppose to be possessed by the Honourable Company, to throw a far stronger light on the "government, laws, and policy" of the Chinese, than any of those productions of mere individual observation or industry to which they have hitherto had access. The truth is, however, that the "outline" of these matters is a very meagre "outline" indeed—compiled from sources perfectly well known, and not aided in the least, to all appearance, by the official opportunities of the author. The main body of the book is composed of a long and somewhat tedious narrative of the trading intercourse of the English with China, the chief incidents being the endless disputes of the factory at Canton with the celestial authorities.

* China: an Outline of its Government, Laws, and Policy, and of the British and Foreign Embassies to, and Intercourse with, that Empire. By Peter Auber, Secretary to the Honourable the Court of Directors of the East India Company. London: Parbury and Co. 8vo. 1834. pp. 419.

These eternal squabbles do not seem always to have reflected the highest possible honour on the character of the English residents, or perhaps of their employers at home. For the former, indeed, there is a grand excuse in the fact of their peculiar position. They were expected to maintain a frank, open, and manly independence, and yet, at the same time, on no account, so to embroil themselves with the Chinese authorities, as to hazard a stoppage, or even a temporary suspension, of "the trade." The Directors, in short, instructed their representatives to sacrifice *every thing* to "the trade," and yet to preserve British "honour and independence" inviolate. No wonder that the factory sometimes found it impossible at times to "make these jarring elements agree;" and no wonder, considering the supremacy of "the trade" in their masters' eyes, that "honour and independence" too often kicked the beam. It is to be hoped that these matters will be a little differently managed for the future, when the chief resident at Canton will be the representative of the nation, and not of a company.

Mr. Auber acts too much like the "honourable court," in giving an undue importance to trade. Two-thirds of his book, at least, are devoted to these portentous doings of the factory, "from the earliest period to the present times," and the other subjects which figure on his title-page are consequently obliged to be crowded into a comparatively small compass, and that not unencroached upon: the opening chapter, for instance, although it promises to be of a tolerably general character, is principally taken up with politico-economical discussion. From the second, which, although of thirty pages only, contains all that the author affords us on the subject of the Chinese "religion, government, and laws," we shall extract a passage of some interest. The Chinese are usually allowed the credit of having preceded us, (European barbarians!) in every discovery of any importance;* but it would seem that the "working classes," or "operatives," of the celestial empire, are still as blind as those of England to the merits of "economical science."

"The revenues of the state are said to amount to 66,000,000*l.* per annum, of which the foreign trade forms only the small portion of 650,000*l.*, and of that but little reaches the imperial treasury.

"The people are remarkable for industry and perseverance; they are largely engaged in the manufacture of cotton goods; and, although the cotton shrub has been long cultivated in China, the extent of their consumption obliges them to import much of the raw material. It is the raw produce generally which meets with the best market in China.

"The Chinese, more particularly the inhabitants of the coasts, are disposed to cultivate foreign commerce; but they are at the same time quite alive to what is likely, in the progress of that commerce, to interfere with their own interests. This was evinced in 1831, when the exportation of cotton twist from England had been so greatly extended. The supracargoes informed the Court of Directors—'In two districts in the immediate vicinity of Canton, and in another about twenty miles distant from it, very serious commotions have taken place among the natives at the introduction of cotton yarn. They loudly complain that it has deprived their women and children, who had previously been employed in the spinning of thread, of their means of subsistence. They have resolved not to employ the cotton yarn in the looms, and have expressed their determination to burn any of it which may be brought to their villages. These districts are very populous, and the people, as is generally the case in China, industrious. While this is a proof of the triumph of English machinery, it is at the same time an indication that its success is calculated to create the same discontent among the working classes there as in other manufacturing countries. We do not learn that the officers of Government have as yet taken any notice of these disturbances. Should they endeavour by high or prohibitory duties to check the importation of cotton yarn, we believe that it would only be followed by an extension of the smuggling trade.'"—p. 63.

It is not improbable, after this, that Trades' Unions will turn out to have been of Chinese origin. There is little doubt that many inventions have been attributed to them on evidence quite as slender.

The East India Company have often been accused of niggardliness of expenditure on every object that had not an immediately commercial bearing. Many

* There are, however, some of our later inventions which have not *yet* been pre-discovered in China: we do not hear of their having either steam-engines or spinning mules.

instances, however, to the direct contrary, might soon be adduced; but the following, from Mr. Auber's volume, will alone be quite sufficient to refute the charge, especially when it is added, that the cost to the Company of the printing of the Dictionary was upwards of *nine thousand pounds!*

"Dr. Morrison had compiled and presented to the Court a Chinese and English Dictionary. It was a work which had occupied great part of his attention for nearly five years, under the impression that it would prove highly advantageous in promoting the acquisition of the native language, not only amongst the Company's representatives, but others, and thereby lead to a more intimate acquaintance with the officers of the government, and with natives of respectability, and thus gradually remove the ridiculous prejudices entertained against foreigners. He offered to superintend its being printed at Canton, provided adequate means could be procured for that purpose.

"The work was to consist of three folio volumes. Part 1.—Chinese and English arranged alphabetically. Part 2.—Chinese and English arranged according to keys, and containing about 40,000 words. Part 3.—English and Chinese.

"The Court of Directors resolved that the work should be printed at the expense of the Company. A compositor and pressman was accordingly sent out, with a printing-press, and types also furnished by the Company. To avoid all offence to the Chinese, the work was to be printed at Macao only. No papers were to be printed for the purpose of being disseminated amongst the Chinese; but, as the printer's time might not be fully taken up, the Court sanctioned his employment in printing any useful work connected with philology, or translations from the Chinese language, or original compositions descriptive of the history, manners, and customs, or arts and sciences of China.

"One hundred copies were to be reserved for the Company, and the rest were to remain with the author to dispose of as he might think proper.

"Sir George Staunton undertook, at the request of the Select Committee, to superintend the work. In its progress the suspicions of the Chinese were awakened, which led to its discontinuance for a short period. In July, 1816, the first part reached England. A further delay took place, in consequence of Dr. Morrison attending the embassy in 1818. The second part was sent home in 1817, and the whole work was completed in 1824.

"The Court permitted the press to remain at Macao, in order to facilitate the acquisition of the Chinese language, by printing translations and other works, but in no way to be applied for political purposes, without the sanction of the Select Committee."—p. 251.

This gigantic undertaking reflects the highest credit on all the parties concerned. The cultivation of the language must infallibly soon lead to a better acquaintance with the people, and that, aided by the throwing open of the trade to British enterprise, can hardly fail to increase "the trade." Mr. Auber gives, in another part of his book, a highly interesting sketch of the Anglo-Chinese College at Malacca, which is proceeding with the most gratifying success; so that, all things considered, in a few years more, China will, most probably, be much less of a *terra incognita* than at present. Notwithstanding the opposition of the government, our merchants aided by the good wishes of the native population, will, doubtless, soon force a trade with other ports than Canton, as, in point of fact, has already been done to a small extent, by direction of the Company's Select Committee, without, apparently, any very disastrous results. European science will penetrate with its commerce, if it has not partially penetrated already. Our "Society for the Diffusion of Useful Knowledge" has a Committee at Canton, in the person of Mr. J. F. Davis, the translator of "Iu-Kiao-Li, or the Two Fair Cousins;" but we are not aware whether he distributes the *Penny Magazine* among the natives. On the late voyage of the Lord Amherst to the Northern ports, however, a short description of England in Chinese, was copiously distributed wherever a landing was made, in spite of the Mandarins; and (such is now-a-days the "progress of journalism") the last accounts from Canton inform us, that a regular periodical, expressly for the perusal of the Chinese, was about to be issued, under the direction of the Rev. Mr. Gutzlaff, who accompanied that expedition, with the special intention of spreading a knowledge of the arts, sciences, manners, laws, and customs of the European world among our celestial brethren. Both parties, therefore, may shortly expect to know and perhaps to esteem each other, far better than they ever have hitherto done.

NOTES AND NOTICES.

The Prussians are known to pride themselves on the superiority of their iron castings of all sorts.—A correspondent of the *Architectural Magazine* (No. 2) thus accounts for it:—" The architects here consider our castings much stronger than yours; they say that they have a smoother and a more compact surface, which, forming a harder case, they allege must be less liable to fracture. You are no doubt aware that the superiority of our castings is owing to the fineness of the sand of which the moulds are made, and that the same sand which is used for casting ear-rings and bracelets is used also for casting joists, rafters, and cannon."

Glass Tiles.—M. Dorlodot, a glass-manufacturer at Anzin, in France, has invented a species of glass tile, of great solidity and transparency, which it is thought may be substituted, with much advantage, in all cases where sky-lights are now employed. The existing excise laws of Great Britain oppose, however, an insuperable bar to their adoption in this country, unless under circumstances where expense is no object.

A new metal, called *Maillechort*, after the inventor, M. Maillot, is coming into use in Paris, as a material for dish-covers, and other similar articles. It is composed of copper 2 parts, nickel 1, zinc 1, iron ⅛, lead ⅜, tin ⅛. It is stated to be very malleable and perfectly innoxious—the copal and arsenic contained in the nickel being neutralised by the other ingredients.—P. B.

" Humanitas" asks, in reference to a late unfortunate accident on the Liverpool and Manchester Railway, " Whether it was not as much the duty of the engineer on the railway train to keep a good look out, as of the poor waggoner, who, in crossing the railway, was run over? And whether the train could not have been stopped, by means of breaks, or by reversing the steam, in time to have prevented the accident?" No doubt it was equally the duty of the engineer to keep a good look out, and in his power also to stop the train nearly instantaneously; but the fact of the accident taking place when the waggon was *crossing* the railway, shows of itself that it must have been run down almost as soon as seen, and that no blame could therefore attach to the engineer.

The very learned and scientific society at Geneva, which corresponds in the nature of its institution with the Royal Society of London, have unanimously elected Mrs. Somerville a member—the first instance of a similar distinction that has been conferred on a female by that learned body. —*Courier*.

Mr. Hall's Steam-engine Improvements.—That well-tried favourite of the public, the Prince Llewelyn, now plying regularly twice a week betwixt the Menai Straits and Liverpool, is the first packet that has been fitted out on Mr. Sam. Hall's principle for the improvement of steam-engines, consisting of a superior method of condensing the steam, and using fresh instead of salt water, thereby creating a great saving in the boilers, and at the same time consuming one-third less of fuel.—*North Wales Chronicle.* We have heard, through other channels, that Mr. Hall's improvements have been productive of such decided advantages on board the Prince Llewelyn, that the St. George Steam Company, to which that packet belongs, have resolved to apply them to all their other vessels.

Geology, like every other science, when well interpreted, lends its aid to natural religion. It tells us, out of its own records, that man has been but a few years a dweller on the earth; for the traces of himself and of his works are confined to the last monuments of its history. Independently of every written testimony, we therefore believe that man, with all his powers and appetencies, his marvellous structure and his fitness for the world around him, was called into being within a few thousand years of the days in which we live—not by a transmutation of species (a theory no better than a frenzied dream), but by a provident contriving power. And thus we at once remove a stumbling-block, thrown in our way by those who would rid themselves of a prescient first cause, by trying to resolve all phenomena into a succession of constant material actions, ascending into an eternity of past time.—*Professor Sedgwick.*

Coals in France.—The *Echo de la Frontière* states, that another mine has been discovered at Saint Mathieu, in the territory of Dourches. More than 150 hectolitres of coal were extracted from the first orifice of the mine. The coal is of very excellent quality. The discovery has excited much interest in that part of the country. A few days ago the miners, who made the discovery, paraded the streets of Valenciennes with specimens, and a grand dinner was given upon the occasion. The scarcity of coal in France has proved an important obstacle to trade, and, therefore, such discoveries as these are looked upon with very great interest.—*Athenæum.*

A hand-loom weaver, of the name of Pickles, at Barnoldswick, near Colne, lately wove, on a dandy loom, in the course of one week, working seventeen hours a day, 30 cuts, 24½ yards long, and about 31 inches wide, making in all 433½ miles of weft. It is calculated that, in the course of this extraordinary performance, his shuttle traversed nearly 800 miles. His net earnings for the 30 cuts was 30*s*.

The Grand Junction Railway (between Liverpool and Birmingham) is now in progress, and is expected to be completed in three years. There are forty miles of the line which may be completed in twelve months.—*Liverpool Times.*

Heaton's steam-carriage shares are at 10 premium, and Church's at 20 to 25 prem.—*Birmingham Advertiser.*

Death of " Jack Fuller."—Professor Faraday, at the conclusion of his lecture at the Royal Institution, on Friday last, announced to the audience that he had just received intelligence of the death of this amiable and eccentric gentleman, of whose munificent gifts to this Institution we had occasion to make mention a week or two ago. The weekly evening meetings have, in respect to his memory, been suspended until the 25th instant.

H. P. (Carrons.) We shall give both plans at the same time, in an early Number; they are much alike.

Answers to several inquiries deferred till next week.

Communications received from Mr. Warren—Mr. Adams—Mr. Ward—W. L. T.—Mentor—J. P. —Mr. Foord—Mr. Tegetmeir—J. L.—Mr. Wallace —A Viewer—Mr. Deakin.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 559. SATURDAY, APRIL 26, 1834. Price 3d.

DISTANCE-REGISTER FOR CARRIAGES.

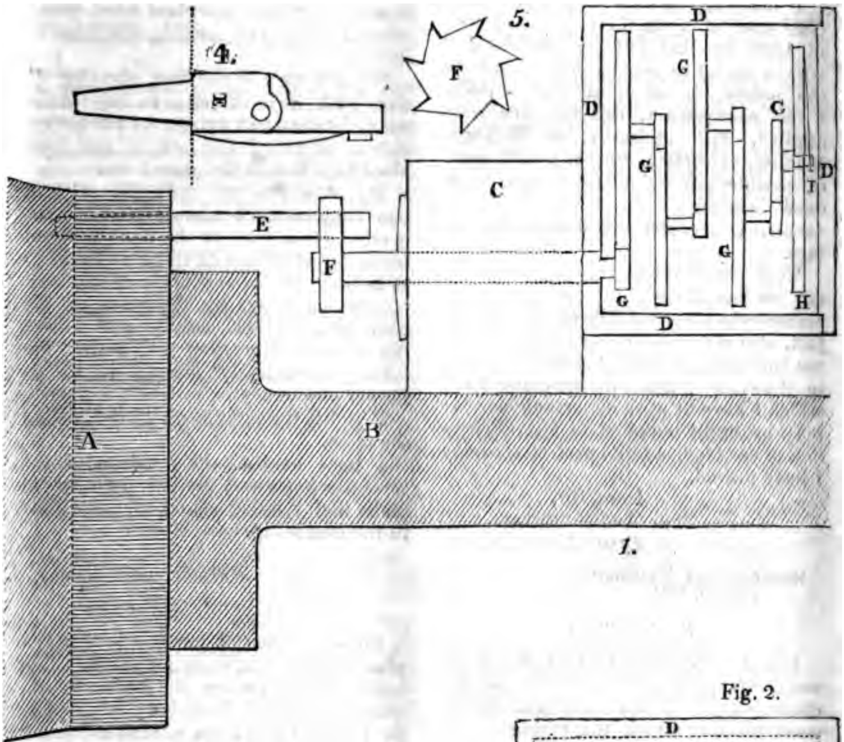


Fig. 3.

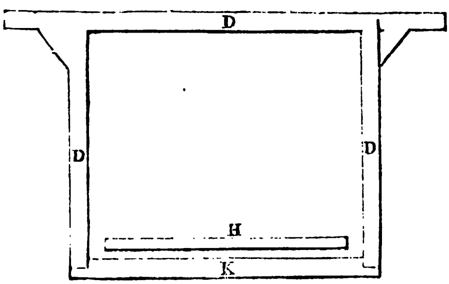
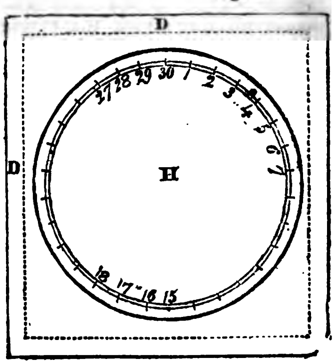


Fig. 2.



DISTANCE-REGISTER FOR HACKNEY-COACHES, CABRIOLETS, &c.

Sir,—I observe in a late Number of your Magazine a paper on a speed-registering apparatus, in which your correspondent suggests that a distance-register for public vehicles would be of much utility, if it could be accomplished.

I herewith forward to you a sketch (full size) of a machine I constructed in 1830 for that purpose, which, if it will be useful to your correspondents, or the public, is much at your service. I feel convinced if this machine were applied, with authority, to hackney-coaches, cabriolets, &c., it would prove of considerable public advantage, by at once obviating the disputes so constantly occurring between the driver and his fare.

Your readers will readily perceive I am no machinist; it was merely for amusement I applied myself to the subject, and if the following explanation is not sufficiently clear, I shall be happy to show any person the machine itself, which I have at work on a stanhope. It may be easily adapted to any description of carriage, and its perfect accuracy I have proved.

I am, Sir,
Your obedient servant,
JAMES HUNT, Jun.

Horseferry-road, Westminster,
Feb. 24, 1834.

*Explanation.**

Fig. 1 is a sectional view of all the work. A represents the nave of the chaise-wheel. B the axle-tree. C the wood block to which the spring of the chaise is fixed. D the brass box containing the wheels and pinions. E an iron stub fixed in the nave A, projecting sufficiently to touch F, a ratchet-wheel with seven teeth, the rotation of which is produced by the stub E acting against one tooth at every perfect revolution of the wheel A. The shaft of E passes through the block C and the box D, and has the first pinion G fixed to it, which it will be readily seen works the whole of the wheels and pinions G. H a dial-plate, engraved with the number of miles from 1 to 30, subdivided into half miles, quarter miles, and furlongs. The division of this plate is, of course, regulated by the circumference of the wheel A, and requires to be done with care. I the hand pointing to the distance, which is attached to the spindle of the last wheel G, which passes through the centre of the dial-plate H.

Fig. 2 is the elevation of the front, showing the face of the dial-plate, which is covered with plate-glass fixed in the rebated sides, and forming the front of the box.

Fig. 3 a plan of the box, showing its size, with the back extended beyond the sides, forming two flanges for the convenience of fixing the box to the wood block C. K K is the glass front.

Fig. 4 shows the stub E, with a knuckle-joint and back-spring. The joint is required to prevent the ratchet-wheel revolving when the carriage is backed; as in that case the resistance of the tooth of the wheel against the point of the stub brings it into action, and allows the stub to slip over the tooth, the spring immediately forcing it to its former position.

Fig. 5 is the ratchet-wheel F showing the teeth.

I have omitted the bearings of the several wheels and pinions, in order to make their relative connexion more clear in the engraving.

* The different figures are reduced in the engraving to one-third the original size.

WORKING INCLINED PLANES.

Sir,—In your Magazine, No. 555, a plan is given for stopping carriages on inclined planes when the chains break, which is stated to have been adopted in St. Helena; and I am quoted as having once said, that "any person who could invent something to do this *effectually*, would not only be entitled to the thanks, but also to a handsome reward, from all inclined plane-workers." I did certainly say so, but I am sorry I cannot give my assent to the "handsome reward" being as yet earned. The desideratum in question seems to me still as much a desideratum as ever. For, only look at the sort of trucks (as I should call them) employed on the St. Helena inclined plane, and it must be seen that nothing of the kind will do to transmit heavy materials over long roads to and from inclined planes, more especially when these roads happen to be carried under

ground for a mile or two, as is often the case in mines. The carriage at St. Helena is made to *stop itself*, but what we want is something to stop the carriages. Instead of making our carriages worse (by far) to travel, that they may stop when the chains break on the planes, we want to make them better travellers than they at present are, that we may do more work with them, *i. e.* take the materials to market at a less expense.

I will now put the case, Mr. Editor, in another way. If the person that planned the carriages on the St. Helena inclined plane had had to travel twenty or thirty miles to the top of that inclined plane, and as far again from the bottom of it, and had to transmit from 200 to 300 tons per diem, I would candidly ask him if he could think of doing it by means of such carriages as those in question?

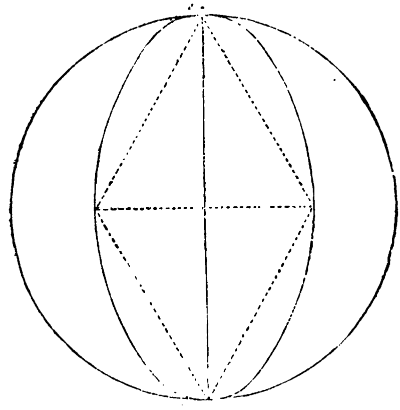
Every person working inclined planes has his peculiar method of building his trains or carriages, to suit his particular purposes. A train to carry limestone will not do to carry bar iron; neither will it do well to carry coal; in fact, different built trains are mixed and passing inclined planes, as they chance to come and go. An *effectual* method to stop *any sort of carriage* on an inclined plane, —be its form what it may—is still the thing wanted.

I am, Sir,
Yours obediently,
J. Deakin.

Blaenavon, April 10, 1834.

ON THE MOST PLEASING FORM OF AN ELLIPSE.

1.



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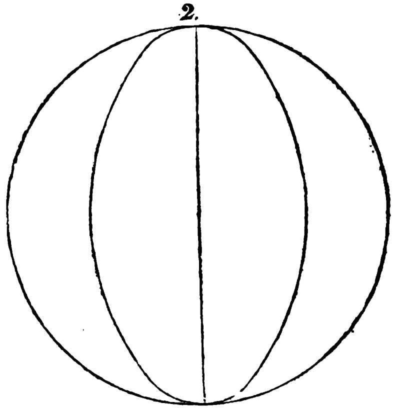


Sir,—An ellipse is a projection or perspective representation of a circle. The form of the ellipse varies with the angle which the plane of projection may make with the plane on which the circle is drawn. When the one plane is perpendicular to the other the projection of the circle becomes a right line. Consequently, between the circumference of a circle and a right line, forming a diameter, every possible variety of form of the ellipse is included. The extremes of the variation of an ellipse are thus very distinctly marked; but to convey to the mind a clear notion of some form between these extremes, there is none in all the variety so well calculated as the "*isometrical ellipse*," which is distinguished from all the others, by its containing two equilateral triangles, whose sides are equal to the minor axis (see fig. 1); and for many purposes to which the ellipse may be applied, this form, as will be observed by the diagram fig. 2, may be called "*the line of beauty*." Any other ellipse of a form between this line and the circle would appear too much rounded; and one nearer the right line would be too much elongated.

From the optical illusion produced by the lines forming the two equilateral triangles within the ellipse in the first

figure, viz. by making the curve at the extremities of the axis appear indented or flattened—as if the dotted lines were cords which, by being drawn tight, bowed out those parts of the curve between their extremities—it becomes necessary to give the two diagrams, in order to describe the peculiar character of the line, and to represent it as the most pleasing form.

Mr. Elliott, who incurred far greater expenses than could well be imagined, without being able to make the isometrical moulds at a price that would be considered reasonable, has by perseverance at length succeeded beyond his expectation.

I am, &c.

JOSEPH JOPLING.

Somerset-street, Portman-square,
April 5, 1834.

PROOFS THAT WAGES ON THE CONTINENT ARE NOT LOWER THAN IN ENGLAND.

(From Preface, by John W. Cowell, Esq., to Tables relative to the Cotton and Silk Mills in the Lancashire District, contained in Supplementary Report of the Factory Commissioners.)

In cotton-working, the rates alleged to prevail abroad (putting out of consideration that they are never stated with reference to hours, but merely relate to periods comparatively vague, such as a day, a week, a month, or a year,) convey no information of the quantity or quality of work turned off in a given time, to realise a given sum of money. They amount, in fact, to nothing more than this, viz., that since 10*d.* is less than 2*s.* so the rate of wages in France, Belgium, Switzerland, and Germany, is lower than in England; and then, by confounding the "rate of wages" with the "payment for work done," it is asserted or implied that the rate of payment for work done is likewise lower abroad than at home.

This consequence would not be true, even if the generality of the evidence as to wages or net earnings approached to accuracy, (which no one can suppose very probable,) still less is it true when no distinction is ever made in this kind of evidence between rate of wages and rate of payment for work done.

A variety of evidence, supported by documents and letters, was tendered in Manchester, to prove that the rate of wages in cotton-working was no where so high as in England. I found myself incapable of attaching much weight to it, even as far as regarded the rate of wages or that of the daily earnings of an individual, and none whatever as regards the rate of payment for work done. I allude to the evidence furnished by Messrs. Pooley, Birley, H. Hoole, Ashworth, and Robert Hyde Greg, particularly to the statistical documents furnished by the latter gentleman.*

Mr. Edmund Ashworth was the most precise in his evidence. He deposed to having examined personally twelve mills in France and Switzerland, and to having found that, in comparison with the wages paid at his own mill near Bolton, the wages of the operative spinners in those countries, taking into view quantity, quality, and time of work, were generally fifty per cent. lower than he himself paid at his own mill at Bolton in money; that the wages of women and children were generally from twenty to thirty per cent. lower; that his evidence on this topic referred to all qualities of yarns; and that the cost of production in cotton-working by power in those countries was, as far as related to money wages, from thirty to fifty per cent. lower than in England. (See D. 1, p. 69, First Report of Factory Commission.)

In this evidence the rate of payment for work done is distinctly asserted to be from thirty to fifty per cent. lower than in England. I am certain that Mr. Ashworth was scrupulously exact in his reports of what he had seen. I am satisfied that he stated what he had learnt on the Continent without any exaggeration in point of fact; and, as to any intention of exaggeration, even the suspicion of such a circumstance is entirely out of the question; but, admitting all that he stated, I do not see that he proved what he sought to establish, viz. that the rate of payment for work done is higher in England than on the Continent.

I had an opportunity of testing, in some measure, the justness of his opinions by the examination of an operative of remarkable intelligence, named Edwin Rose, who had been at Mulhausen for several years, which was one of the places that Mr. Ashworth had visited. (See D. 1, page 121, and page 69, First Report of the Factory Commission.)

Edwin Rose states, that the rate of wages or earnings at Mulhausen of an operative spinner, was from thirty to thirty-five sous a day, and that the children gain from seven to eight sous a day; that they can only spin coarse works (yarn of no greater fineness than of forty hanks to the pound) at Mulhausen; that at the largest factory there, that of Messrs. Maeg's, there were no mules

* The evidence of Messrs. Pooley and Ashworth will be found in our last volume, page 110. We also intended to extract at length that of Messrs. Hoole and Greg; but after the very able and correct analysis of it here given by Mr. Cowell, this seems unnecessary.—ED. M. M.

(spinning-machines) carrying more than 200 spindles; and that one adult and two children were employed on each separate mule.

Thus it appears that one adult and two children are requisite for the management of 200 *coarse* threads in the best mills at Mulhausen, and that they gain among them about 2s. a day at *coarse* work.

One adult and two children in England, at Manchester, Oldham, Stockport, and a variety of other places, will gain among them at *coarse* work about 5s. 6d. a day.

Thus the rate of wages in England appears to be as eleven-fourths compared with the rate of wages at Mulhausen, but the average number of threads which a spinner and two children are *capable* of managing in England cannot be less than 758 on the best machinery, for I saw this *actually* done at Mr. Ashworth's own factory; therefore the quantity of work which can be turned off in England by a spinner and two children is to that which can be turned off by a spinner and two children in France, in equal times, as 758 : 200.

From a comparison of these elements it will appear, that the French operative receives 4 where the English operative receives 2.90 (which I will call 3) for an equal quantity of work of the same quality.

But this examination, though conclusive, is not stated with all the strength of which it admits.

I have taken the number of threads which a spinner and two children are *capable* of watching during the progress of coarse spinning as = 758 on the best machinery; but I have no doubt (though I have not seen it done) that the three together are capable of managing *at the rate* of 800 threads on the best machinery in *coarse* work.

Again, Edwin Rose could not be certain that the motion of machinery was as rapid in France as in England, consequently it is not clear that *equal* numbers of threads are spun per spindle in *equal* times in the two countries. Again, the length of a thread spun in Manchester by one effort of the machine is fifty-four inches; but the vast inferiority of the machinery at Mulhausen, which is indicated by the facts stated by Rose, would lead to the supposition that it is not sufficiently *steady* to spin a thread so long as fifty-four inches.

Thus there is no evidence to show that a French spindle turns off as much thread in equal times as an English spindle.

But without at present requiring any allowance for these two last considerations, we see that it requires four men and eight children to spin 800 threads at Mulhausen, for doing which they receive 8s. per day among them, while one man and two children are capable of spinning the same number of threads of the same quality in England, for whic hthey receive 5s. 6d.

But in order to obviate all cavil, I will take the daily earnings of a man and two children spinning the average of coarse counts under forty hanks to the pound on the best English machinery at 6s. a day. The comparison will then stand thus, viz. the rate of pay for work turned off in spinning the average of coarse counts under No. 40, on the best machinery at Mulhausen, is to the rate of pay for spining the same quality of work oh the best machinery in England as 8s. are to 6s. The rate of payment for work done is still twenty-five per cent. lower in England than at Mulhausen (which Mr. Ashworth told me was called the Manchester of France), after I have added one-eleventh to the amount earned, and abandoned two elements of great importance in this calculation, viz. the steadiness of the machine and the rapidity of its motion, determining respectively the *length* of the thread that it can spin by one energy, and the *number* of threads which it can spin in any given time.

Edwin Rose, the witness as to the facts at Mulhausen, is an operative machine-maker, now in the employ of Messrs. Sharpe and Roberts, of Manchester, one whom those gentlemen pointed out to me as a person of good sense, good character, and on whose veracity I could depend. He deposed to facts which fell under his own observation at Mulhausen, and the nature of which he thoroughly understood.

I myself saw a great number of mules (spinning-machines) in Mr. Ashworth's own factory at Egerton, at which an adult and three juvenile assistants managed 1,024 threads among them. This gives an average of 256 a head, and they were spinning yarn of the fineness of from seventy to eighty hanks to the pound at the time of my visit.*

* It is necessary to point out here that I do not assert that the number of threads *actually* managed, upon the average, by an operative in the spinning department, is 266 (or 800 threads for three operatives), but that one person is *capable* of managing this number on machinery of the first class, and as the evidence of Edwin Rose regards machinery of the first class at Mulhausen, the comparison is fairly made between machinery of the first class in France and in England.

The number of threads which a spinning operative manages on the best machinery at Mulhausen is 66⅔, spinning coarse threads under No. 40; the number which a spinning operative manages on the best machinery at Bolton is 256, spinning threads of *double* the fineness, viz. from Nos. 70 to 80.

It is impossible to say what is the average number of threads *actually* managed by a spinning operative in general; but from returns made to me at Bolton it appears that in that town and neighbourhood there are seventeen mills, containing 580,216 mule-spindles, and employed 792 mule-spinners, and that the proportion of piecers to spinners is as

As to the evidence of the average earnings of an operative spinner spinning coarse numbers, (under forties, which is the quality taken by Edwin Rose at Mulhausen,) I am satisfied, from repeated examinations of numerous operatives in different factories at different places, taken while they were at their work, that they never exceeded 24s. a week, which would be 4s. a day at the highest; and adding the earnings of two juvenile assistants, one at 6s. and the other at 3s., which all who understand the matter will admit to be high, the earnings of the whole three taken together cannot be made to exceed 5s. 6d. a day for work of the quality of No. 40.

These considerations certainly show that the rate of payment for work done is lower at Bolton than at Mulhausen, and they exhibit the nature of that evidence so often adduced to prove that the rate of payment for work done abroad is generally lower than that prevalent in England.

* * * * *

It seems to me that Mr. Robert Hyde Greg, who delivered into the Factory Commission at Manchester a number of documents relative to the rate of wages in different countries in cotton-working (see his evidence, pp. 30 to 39, D 2.), would nevertheless have found himself at a loss to form any idea in general of the rate of payment for work done in those countries, and that if he were told that it was variously from 500 to 1,000 per cent. higher on the Continent than at home, these documents would have lent him but little assistance in refuting the assertion. What should be produced on these occasions are scales similar to the one which I have quoted, and evidence as to the quantity of work done by men of average skill and strength in given times under the same set of circumstances. Such elements of comparison do not exist. When Mr. Greg states that the rate of wages of a spinner in Alsace are from two to two and a half francs a day, and those of a piecer from eight to twelve sous,—that in Switzerland, a spinner's wages are from 6s. to 12s. English a week, and those of a piecer from 2s. to 3s., and so on, of the rate of wages of cotton-workers in the Russian dominions, in Baden, and at Naples, —how does this evidence avail him to prove that the rate of payment in those countries for work done is lower than in England, even though every English operative cotton-worker were earning *5l.* a day?

He produces the following table of the comparative cost of production of a pound of yarn of the fineness of forty hanks to the pound in Switzerland and England:—

PROCESSES.	Manchest.	Switzerl.
	d.	d.
Preparations, &c . .	71.3	.664
Spinning	1.155	1.236
Reeling, &c. . . .	.755	.513
Contingent expenses .	1.071	1.041
Interest of capital . .	.812	1.012
	5.206	4.666

The wages of labour are contained in the three first of these items, and partly in the fourth; and by their agency we are told that the Swiss producer can offer cotton yarn of the fineness of forty hanks to the pound in the market of the world at a prime cost of 4½d. (say) the pound, while the prime cost of the English producer is 5¼d. (say); and his evidence proceeds:—"Thus the only advantage in England is the lower rate of fixed capital, arising from more work being done by the same machinery. This is the *sole* item of cheaper production, &c."

But he states nothing to disprove the fact which I have shown to exist, that besides the advantage arising from superior machinery in a saving of interest of capital, another source of cheaper production arises from superiority of machinery, which is "*a lower rate of payment for work done.*"

An English cotton-mill owner, knowing that the wages of an English spinner vary from 10s. a week to 50s. according to the quality of yarn that he spins, and to other circumstances, visits a cotton-mill at Salerno in Naples, and finds that a spinner's wages there are 6s. a week.

It is apparent, on the face of this statement, that "wages" are higher in England than at Naples. But is the rate of payment for work done higher? This is the conclusion which Mr. Greg's testimony as to the facts

3.12 : 1; consequently at Bolton four spinning operatives actually manage 732 threads among them, which is 183 a-piece. Some of the machinery there was very bad (for English machinery); some was very good. In three of the mills which I visited (containing 183,406 spindles out of the whole number of 580,216) they were spinning yarn of the fineness of from sixty to eighty hanks to the pound, which circumstance alone would prevent any general conclusion from these premises. All that I am anxious to show is, "that an English operative spinner and two juvenile assistants are *capable* among them of managing *at the rate of* 800 coarse threads of fifty-four inches in length on the best machinery. I prove them to be capable of managing *at the rate of* 738 fine threads of fifty-nine inches long on the best machinery; and the finer and longer the thread, the oftener it breaks during spinning, and the greater, consequently, is the number of piecers requisite for assisting the spinner. Hence I can scarcely doubt but that a spinner and *three* assistants can manage a pair of mules of 536 spindles each mule (=1,072, the pair) for coarse work. This would show that a spinner and two assistants are capable of managing 804 coarse threads among them.

which fell under his observation at Salerno might be taken to establish, and on this founded a new conclusion, viz. that the cost of production is higher, *cæteris paribus*, in England than at Naples; and on this ground the legislature is invited to make or abstain from making certain laws.

As this ground was taken up in general by Messrs. Birley, Hoole, Ashworth, and various others, in their evidence on the factory question, it is desirable that the soundness of it should be appreciated at its just value.

The first defect, as it appears to me, in Mr. Greg's statement regarding the rate of wages at Salerno, is, that he does not say whether they pay according to quantity turned off, or according to fixed weekly wages. The second is in not stating whether, supposing them to pay in proportion to quantity turned off, the rate of such payment at Naples varies with the productiveness of the machine employed. The third is in not giving an accurate measure of the efficiency of machinery, which, as a cotton master, it was easy for him to appreciate.

The mill at Salerno possessed, Mr. Greg says, "about 7,200 spindles, and the machinery was good and on the newest principle, including Mr. Dyer's patent roving-frame." Are we to conclude from these expressions that the machinery was as good as Mr. Ashworth's? If so, the spinning department would have employed seven male adults and twenty-eight juvenile assistants: total, thirty-five persons. If, on the other hand, it was as good as the best machinery at Mulhausen, it would have required thirty-six adults and seventy-two non-adults: total, 108 persons. How great the difference, and how impossible is it to compare the rate of "payment for work done" between Bolton, Mulhausen, and Salerno, from such data.

By neglecting to state how many adults and how many juvenile hands were really employed in the spinning department of this mill to manage 7,200 spindles, Mr. Greg has omitted to furnish the third element, which is essential to the justice of his conclusion, viz. that in consequence of the lower rate of wages abroad, the cost of production is, *cæteris paribus*, higher in England.

No light whatever is thrown upon the comparative goodness of spinning machinery in two countries by such expressions as "that it is good, and on the newest principle." On the contrary, they may lead to erroneous inferences. In judging of the comparative excellence of the spinning-machine called a mule (which is a *System* of spindles), it is necessary to know,—

First, How many spindles it carries, or, in other words, how large the *System* is.

Secondly, The length of the thread which it is capable of spinning at one effort.

Thirdly, The time required for the performance of this effort.

Fourthly, The extent to which it is suited to spin yarn of different qualities.

Fifthly, The number of intelligent agents of several degrees of strength and skill which it requires to guide and watch it.

The witness whose evidence throws light on this topic is Edwin Rose, where he says that he saw no mules at Mulhausen carrying a greater number of spindles than 200, or capable of spinning yarn finer than of forty hanks to the pound, and that each of these required one adult and two juvenile assistants. Notwithstanding that this machinery is immeasurably inferior to that in England, it might still have been both "good and on the newest principle." Nevertheless the rate of payment for labour which it compels the master manufacturers to pay at Mulhausen is twenty-five per cent. greater than that paid by the master manufacturers in England, even when we only take into consideration the *fifth* ingredient of those which I have just mentioned as determining the quality of a machine.

Were I to attempt estimating the extent to which the other four ingredients serve, first, to reduce the rate of payment for labour in England, and, secondly, the charge of "interest on sunk capital," the triumphant and apparently unassailable superiority of England over what are called her Continental rivals would be very apparent, though the other elements in cost of production, besides rate of payment for labour and interest on capital, were neglected.

Mr. Edmund Ashworth and Mr. Pooley, who has visited Ghent, estimated in their evidence the advantage on the whole cost of production possessed by the Ghent manufacturer over the English one as varying from 5 to 7½ per cent. Mr. H. Hoole estimated his advantage at 20 per cent., and Mr. Birley at 40 per cent. If the lowest of these estimates were correct, the wonder is that the English spinners should not have been totally ruined long ago.

Since this evidence was delivered in June 1833, a deputation of the Ghent manufacturers, though thus alleged to possess an advantage in offering their yarns in the market of the world varying from five to forty per cent, in prime cost over English yarns, have represented to his Belgian Majesty that they are ground to dust by the pressure of English competition; they have demanded the most absolute exclusion of English yarns and manufactured goods, and in addition they have declared that a com-

pliance with these demands will not save them from ruin, and that they shall be unable to continue the business unless they are protected by a bounty on the article which they produce. What opposite views are entertained on the same point at Ghent and at Manchester by persons who are apparently equally entitled to challenge attention to their opinions! Messrs. Poleman and Turranke are practical authorities at Ghent; and no persons are more justly entitled to that character at Manchester than Messrs Birley and Hoole.

The various Supplementary Tables relative to the 151 mills which returned the number of hours which they worked during the month ending 4th May 1833, will certainly suggest to those acquainted with the subject considerations of a nature to re-establish confidence, supposing it to have been shaken by the fear of foreign competition springing from the belief that the rate of payment for work done is lower on the Continent than in England, and they will afford those who follow up the subject in general the means of appreciating the title to accuracy of much of the evidence which has been advanced regarding the rate of wages at home and abroad. I shall conclude this topic by an extract from the evidence of Edwin Rose.

Evidence of Edwin Rose, Operative Engineer (D. 1, p. 122, First Report, Factory Commission.)

Returning to the point of wages, are they lower in France, as far as you have seen, than in England?—If I have a shop of men in England for any thing, then I have to see how much I have got to pay them for the work they turn out of any kind; but if I have the same shop in France, then I must have twice the number of hands to do the same amount of work. It is true I pay them less a-piece there; but I have seen that you must have twice as large a building to contain the hands, twice as many clerks and book-keepers, and overlookers to look after them, and twice as many tools to do the same quantity of work as is done here in England; and the master there must have twice as much interest of money on all this; and their minds seem to me to get more bewildered with stress of work there than here. It seems to me that you have double the number of people there to do the same amount of work, whatever it be; but their wages are lower in money.

But do you consider their wages higher in reality?—I really do; they are better paid, in proportion to the work they turn out, than what the English are.

Do you judge this of the spinners and cotton-printers, as well as of other workmen, with whom you met in France and Switzerland?—Certainly, I mean it in general; but I should say that the Swiss are better workmen than the French. They are more ingenious, and lay closer to their work a deal.

Have you, as a workman, and having been in a large manufactory at Mulhausen, and being in one in Manchester, any doubt whatever that the rate of wages is really higher in France than it is in England?—I have no doubt at all; not a bit.

What do you think of French workmen as workmen?—I don't think they have that perseverance that English have. I often have noticed them trying a thing, and then if it don't answer at first they seem terrified, and shrug up their shoulders and throw it aside; but an English workman keeps trying and trying, and wont give up near so soon as the Frenchman.

In what description of work in machinery do you think they excel the English?—I am not aware of any. I don't know what machinery they excel in. In the stove-pipe manufactory and light copper vessels they are very clever, and better than us, I do consider. I think their copper covers very good, and their copper boilers for steam-engines likewise. In copper piping I have seen some excellent work done connected with high-pressure engines.

Now what did these copper boilers and copper piping stand in?—They were better paid for them than they would have been paid for here in wages. The material is, I think, pretty near the same in value, but they took more time to do those things there than here, and the wages amounted to more.

What is their tin work?—There is a great deal of it. Lead is very expensive there, and they use much more tin in water-pipes and on the roofs of houses than we do.

But can they make a tin drum for throstles?—Well, I know my father-in-law at Kœchlin's had the worst job in the world to get a tin drum made for throstles. We had to have it pulled to pieces five or six times, and, after all, it was very bad; not such as we would turn out.

Is there much German tools and cutlery coming into Mulhausen?—Some; chiefly cutlery.

What is it, compared with English, in price and quality?—About one-third dearer, and not to compare with ours at the same price. A Frenchman generally seems to know the superiority of our work; he will give more for it a great deal. All the files we used at Kœchlin's came from England, and had to pay 8*d*. a pound duty, I believe; their steel of all descriptions used at Kœchlin's came from England, though charged with a heavy duty. This must naturally show the disadvantages under which they labour.

Judging from what you have seen, do you think the French manufactory can rival the English?—Oh no; that's quite entirely out of the question.

What do you think of the Swiss?—I consider they are more like a race of English people, and apply themselves steadier to work than the French do.

But can they beat and undersell us in cotton goods?—I should certainly say no.

What is the rate of wages for a collier in France?—At Ronechamp they let the work by auction. They seemed to me to average about twelve francs a week; and then their wives work there in the collieries just as the men do. I went to Ronechamp to put up pumping tackle to the engine. There were a great number of persons employed. I have seen 590 waggons standing to be laden with coals in one day. But the price came very heavy; it was twenty-five sous, or 1*s*. 0½*d*. a hundred weight at the pit's mouth. They were inferior to our coal, and weighed very heavy. A house-joiner or carpenter's wages were from thirty-five to forty sous a day. His work, compared with English work, is very rough, and but little of it in comparison. A plasterer about three and a half francs a day, if he is a finisher; those that lay on the rough coating about thirty sous a day. The plasterer's work is as good as ours, and perhaps more fanciful. A stonemason's wages are from three francs to four francs. They are inferior to our masons in laying foundations. Then, as to time of work, I think two English masons in the same time do more work, upon an average, than three of theirs.

In short, do you know any single kind of labour that stands in cheaper to a master in France than in England, quality and quantity of work being considered?—I don't know any, unless it be tailors' and shoemakers' wages; but I am not sure about them. Clothes are dearer in France than in Eng-

land; but shoes are cheaper, the duty being off leather. Then I think paper is cheaper, and that they excel us in that branch, as far as paper for covering rooms is concerned, in taste and colours, and the price is very low, there being no duty on paper.

Mr. Roberts told me to-day that he used the French screws in his manufactory, and that he found them cheaper than the English, though they ranged to double the price; and that this was owing to their good shape and exact cut; what can you say about this?—I certainly say they are cheaper upon the whole. You can trust to French screws more than English; their spiral is more regular; their thread more even; they taper, which is of great consequence; thus they get tighter in the wood all the way they go. Ours are knocked off that cheap that they are little better than nails.

Was much English twist smuggled into France while you were at Mulhausen?—Yes, a great deal; particularly fine numbers. My father-in-law, who is now in business as a machine-maker at Stockport, was Mr. Kœchlin's manager; and when he was going to leave him, offered, as a favour, to make him a pair of fine mules for his brother-in-law, Mr. Beaucart; but Mr. Kœchlin said it was of no service, for so much English fine twist was smuggled into France in winter from Switzerland, over the ice during the long nights, that there would be no use at all in trying them. It was notorious at Mulhausen that plenty of English twist was smuggled in there. It was generally fine twist for weaving lace. I don't know whether any coarse numbers were smuggled in or not.

What should you say of French iron, best quality, as compared with ours?—It is about one-third higher in price, and the castings are one-half as high again, and not so good.

Is there any thing else that you wish to add to your evidence?—You asked me in what works the French and Swiss were superior to us. I think the Swiss beat us in mathematical-instrument making. There is a great number of them in London, getting high wages. They come chiefly from about Berne and Neufchatel.

COMPARATIVE INTENSITY OF DIFFERENT LIGHTS.

We witnessed at the National Gallery in Adelaide-street, on Wednesday evening, a very pleasing and well-managed exhibition of the comparative intensity of different modes of illumination—those in particular which are employed in marine light-houses, and geodesical operations, or are considered peculiarly applicable to those purposes. In several respects, however, the exhibition failed to do perfect justice to the subject. We shall not, therefore, in the following report, confine ourselves to the facts which it brought into view, but introduce, as we proceed, many interesting particulars derived from other sources.

1. The method of lighting adopted universally in the British light-houses, namely, by Argand lamps, with parabolic reflectors, was the first exemplified. The merit of their introduction—if not invention—is due to our venerable and esteemed correspondent, Mr. Ezekiel Walker of Lynn (see Mech. Mag., vol. xv., page 91). The first light-house on this plan was the Hunston, on the Norfolk coast, and it was fitted up, we believe, under Mr. Walker's personal superintendence. This was in 1778, but it was more than twenty years later before the plan came into universal use. As late as 1811 the Eddystone was lighted with wax candles, and in 1812 the Lizard with coal fires! The parabolic reflectors are usually formed of copper, lined with highly-polished silver, and 21 inches in diameter at the mouth, with a depth of 9. The Argand lamps, about ⅞ of an inch in diameter, are placed in the foci of the reflectors. The number employed varies with the degree of brightness required. A hole in the reflector, immediately above the flame, permits the escape of the smoke. For the sake of distinction, some of the lights on this plan are fixed, others revolving. When fixed the lamps are disposed round a circle; when revolving in three, four, or more segments or faces. The light is most intense when the lights revolve. Mr. Stephenson, the engineer of the northern light-houses, has invented a reflector-flame, by which the revolution of the lights is greatly accelerated. It has been applied to Buchanness, which has, from this circumstance, the appearance of a flashing light. Fixed lights are of course only preferred in situations, where it is merely requisite that small portions of the horizon should be illuminated. The light-houses lately erected on Beachy Head, and on the Perch Rock at the mouth of the Mersey, are revolving lights, and are considered two of the best specimens of this means of illumination. The greatest distance at which lights of this description have been known to be visible is forty-four miles.

2. The effect of colouring lights, for the purpose of still further distinction, was next shown. Red lights are obtained by simply placing a red glass before the reflector, but are 65 per cent. less bright than white ones. When in a revolving lighthouse, two faces are white and one red, it frequently happens that the red light is not seen at all, while the white ones are clearly distinguished. Although

red lights are thus inferior, they are found, for local purposes, extremely useful. In some cases a white light is arranged so as to have one or more red reflectors, which throw out the rays of light which illuminate the vicinity of shoals or other dangers, so that the navigator, to be in safety, must keep in the white light. At Caldy, in Wales, a fixed light has been constructed in this manner, having two red reflectors, which indicate a danger in the approach.

[illegible] vegetable and animal [illegible] have been tried with the Argand [illegible] but that [illegible] to produce [illegible] generally [illegible] was [illegible] has [illegible]

[illegible] gas has been substituted in [illegible] and its [illegible] light-house at [illegible] with gas and [illegible] parabolic reflectors. [illegible] the coast [illegible] illuminated by [illegible] centre of each lantern is a [illegible] with forty-[illegible] a brilliant body of [illegible] The use of gas [illegible] advantage—that the size [illegible] can be increased to any [illegible] and is not liable, in the longest [illegible] by negligence of the [illegible]. But it has been found that, in [illegible] nothing is gained; and [illegible] gas, therefore, has no superiority [illegible] where a light is required to be [illegible] great distance.

[illegible] Messrs. Arago and Fresnel [illegible] that a plano-convex lens [illegible] to a burning glass) [illegible] substituted for the parabolic [illegible] and this has led to the general [illegible] in the light-houses of [illegible] The Cordovan light-house, at [illegible] the Garonne, which has the [illegible] being the finest in the [illegible] in this manner. [illegible] diameter than [illegible] presumable, and [illegible] much larger di- [illegible] requisite, [illegible] would not have found [illegible] but for the discovery of our distinguished countryman, Sir David Brewster, that by surrounding any lens with a series of glass rings, of a particular curve, it might have its effect magnified to any given extent, or, in other words, that one great lens might be composed of many separate parts; hence the term *polyzonal lenses*, by which this mode of reflection is now commonly known, in contradistinction to the parabolic method. When lenses are thus employed, the lantern is constructed of eight sides, which form an octagonal prism around the lamp, whether oil or gas be the illuminating material made use of. The centre of each side is occupied with the lens, and the rest of the space is filled up with the rings just spoken of. As it is obviously essential that the light should be equidistant from the reflecting surfaces, and of the greatest possible brilliancy, a lamp is employed which has three concentric wicks, the outermost of which is no less than 3¼ inches in diameter; and lest the extraordinary heat thus produced should carbonise the wick, the supply of oil is so managed as to be always verging towards excess. Fresnel states, that he kept a fourfold wicked lamp of this description for fourteen hours without snuffing it, and that the rays thrown by a lens placed before it, had, at the end of that time, lost only one-sixth of their original intensity.

Sir David Brewster has taken great pains to promote the adoption of polyzonal lenses in this country, and though hitherto without effect, it must be allowed that he has the majority of the scientific world on his side. "The unalterableness of the glass and the lasting nature of its polish are great advantages; and in point of economy it is decidedly preferable, as the quantity of oil it expends is one-third less than is used to produce the same quantity of light by the other plan (of parabolic reflectors); and an immense deal of labour and chance of neglect is spared, as the glass requires little cleaning and as there is only one lamp to attend to. But this method is not without disadvantages. The difficulty of repairing the lenses and the trouble attending a replacing of the wicks is very great; and as the light depends on one lamp, should any accident occur the results might prove fatal. Besides it has been remarked, and can be demonstrated

hat the French lens gains in con- ion of light, it loses in divergency; degrees is the utmost to be ob- , whereas in the English (or para- method fifteen is the average quan- hat is, the English light would be on fifteen degrees of the horizon, ench only on twelve."*

The greatest obstacle, however, to option of the polyzonal lens system ction is doubtless the recent dis- of a mode of illumination which is e of giving to the parabolic reflectors their wonted power. We allude t. Drummond's method of produc- intense light by the projection of en and oxygen gas in separate but tely uniting streams on a ball of We gave an account of this dis- at the time of its first announce- and it has since become familiar e sight-going portion of the public h the admirable application made o entomological purposes, in the oxygen gas microscope. No other which has yet been discovered near to this in splendour and in- ; it is only inferior to the sun it- n Ireland, where it was employed t. Drummond in nocturnal tri- tion, it is said to have been seen at nce of ninety miles! In May series of experiments were insti- under the direction of the Trinity which proved beyond all doubt eriority over every other species of whether aided by parabolic reflec- polyzonal lenses. At first the ime (about three-eighths of an inch neter) was placed on the focus of lector, and when consumed was d by another and so on; but Mr. nond has lately preferred making a self-supplying cylinder of lime, cted on the same principle as the inted pencils. As the lantern s it gives motion to a stem which the stick of lime upwards, so that ortions of lime are presented to am of the gases in constant suc-

asy mode of obtaining a light of logous description to Mr. Drum- , though of inferior brilliancy, en pointed out by Mr. Talbot, or Chippenham. "It is only re- ," he says, "to place a lump of common salt upon the wick of a spirit lamp, and to direct a stream of oxygen gas from a blowpipe upon the salt. The light emitted is quite homogeneous, and of dazzling brightness. If, instead of common salt, we use the various salts of strontian, barytes, &c., we obtain the well-known coloured flames which are characteristic of these substances, with far more brilliancy than by any other method with which I am acquainted."

7. An angular piece of charcoal was placed in the focus of a set of parabolic reflectors, and a stream of electricity directed upon it from a volcanic battery; a light was thus produced of great brilliancy, but of a scintillating, or rather, intermittent description. The same experiment was repeated with a stream of electricity, produced magnetically from Mr. Saxton's magno-electric apparatus,* and with a similar result.

Every experiment made however on this occasion, only served to establish more completely to the satisfaction of every one present, the immense superiority of the *Drummond Light* over all others; and to induce a general feeling of surprise, that no steps have yet been taken to introduce it into any of our light-houses.

N. R.

NOTES ON THE MANUFACTURE OF CHINESE PAPER.

(Communicated to the Society of Arts, by John Reeves, Esq., late of Canton, and published in the Second Part of their Transactions for 1833.)

On the making of Chinese Paper; translated from the twenty-third volume of the Pun Tsaou Kang Muh.

In ancient times, bamboos were connected together, and letters burnt on them, to form books; and hence the several characters employed to denote papers and documents are formed partly with the character for "bamboo."

In the time of the Tsin and the Han dynasties, letters were written upon silk cloth; and hence the characters for silk and cloth are component parts of the character used for paper.

In the time of the Emperor Ho Te (A. D. 100), Tsac Lun began to take the bark of trees, old silk of different kinds,

* ited Service Journal, No. 65, p. 464.

* We have been favoured by Mr. Rutter with a drawing and description of a magno-electric apparatus, made for him by Mr. Saxton, which we I give next week.

red lights are thus inferior, they are found, for local purposes, extremely useful. In some cases, a white light is arranged so as to have one or more red reflectors, which colour only the rays of light which illuminate the vicinity of shoals or other dangers, so that the navigator, to be in safety, must keep in the white light. At Caldy, in Wales, a fixed light has been constructed on this principle, having two red reflectors, which indicate a danger in the approach.

3. All sorts of vegetable and animal oils have been tried with the Argand lamps, but that which is found to produce the most light, and is therefore generally preferred, is spermaceti. Cocoa-nut oil, of the excellence of which so much was said at one time, has been tried, but without success.

4. Coal gas has been substituted in some foreign light-houses for oil, and its adoption here has many strenuous advocates. In 1819, the new light-house at Dantzic was lighted with gas, and furnished with a large parabolic reflector. Salvatore and Promontore, on the coast of Istria, are also both illuminated by gas. In the centre of each lantern is a candelabrum, provided with forty-two spouts, from which a brilliant body of flame is transmitted. The use of gas has this great advantage—that the size of the flame can be increased to any volume, and is not liable, in the longest nights, to suffer by negligence of the keeper. But it has been found that, in point of *intensity*, nothing is gained; and that gas, therefore, has no superiority over oil, where a light is required to be seen at a great distance.

5. In 1818, Messrs. Arago and Fresnel recommended that a plano-convex lens (somewhat similar to a burning glass) should be substituted for the parabolic reflector; and this has led to the general adoption of lenses in the light-houses of France. The Cordovan light-house, at the mouth of the Garonne, which has the reputation of being the finest in the world, is illuminated in this manner. But as lenses of greater diameter than 15 inches are not easily procurable, and reflecting surfaces of much larger dimensions are, in most cases, requisite, the lens system would not have found the favour which it has with our intelligent neighbours, but for the discovery of our distinguished countryman, Sir David Brewster, that by surrounding any lens with a series of glass rings, of a particular curve, it might have its effect magnified to any given extent, or, in other words, that one great lens might be composed of many separate parts; hence the term *polyzonal lenses*, by which this mode of reflection is now commonly known, in contradistinction to the parabolic method. When lenses are thus employed, the lantern is constructed of eight sides, which form an octagonal prism around the lamp, whether oil or gas be the illuminating material made use of. The centre of each side is occupied with the lens, and the rest of the space is filled up with the rings just spoken of. As it is obviously essential that the light should be equidistant from the reflecting surfaces, and of the greatest possible brilliancy, a lamp is employed which has three concentric wicks, the outermost of which is no less than 3½ inches in diameter; and lest the extraordinary heat thus produced should carbonise the wick, the supply of oil is so managed as to be always verging towards excess. Fresnel states, that he kept a fourfold socket lamp of this description for fourteen hours without snuffing it, and that the rays thrown by a lens placed before it, had, at the end of that time, lost only one-sixth of their original intensity.

Sir David Brewster has taken great pains to promote the adoption of polyzonal lenses in this country, and though hitherto without effect, it must be allowed that he has the majority of the scientific world on his side. "The unalterableness of the glass and the lasting nature of its polish are great advantages; and in point of economy it is decidedly preferable, as the quantity of oil it expends is one-third less than is used to produce the same quantity of light by the other plan (of parabolic reflectors); and an immense deal of labour and chance of neglect is spared, as the glass requires little cleaning and as there is only one lamp to attend to. But this method is not without disadvantages. The difficulty of repairing the lenses and the trouble attending a replacing of the wicks is very great; and as the light depends on one lamp, should any accident occur the results might prove fatal. Besides it has been remarked, and can be demonstrated

that what the French lens gains in concentration of light, it loses in divergency; twelve degrees is the utmost to be obtained, whereas in the English (or parabolic) method fifteen is the average quantity—that is, the English light would be visible on fifteen degrees of the horizon, the French only on twelve."*

6. The greatest obstacle, however, to the adoption of the polyzonal lens system of reflection is doubtless the recent discovery of a mode of illumination which is capable of giving to the parabolic reflectors double their wonted power. We allude to Lieut. Drummond's method of producing an intense light by the projection of hydrogen and oxygen gas in separate but ultimately uniting streams on a ball of lime. We gave an account of this discovery at the time of its first announcement, and it has since become familiar to all the sight-going portion of the public through the admirable application made of it to entomological purposes, in the hydro-oxygen gas microscope. No other light which has yet been discovered comes near to this in splendour and intensity; it is only inferior to the sun itself. In Ireland, where it was employed by Lieut. Drummond in nocturnal triangulation, it is said to have been seen at a distance of ninety miles! In May 1830 a series of experiments were instituted under the direction of the Trinity House, which proved beyond all doubt its superiority over every other species of light, whether aided by parabolic reflectors or polyzonal lenses. At first the ball of lime (about three-eighths of an inch in diameter) was placed on the focus of the reflector, and when consumed was replaced by another and so on; but Mr. Drummond has lately preferred making use of a self-supplying cylinder of lime, constructed on the same principle as the ever-pointed pencils. As the lantern revolves it gives motion to a stem which pushes the stick of lime upwards, so that fresh portions of lime are presented to the stream of the gases in constant succession.

An easy mode of obtaining a light of an analogous description to Mr. Drummond's, though of inferior brilliancy, has been pointed out by Mr. Talbot, M.P. for Chippenham. "It is only requisite," he says, "to place a lump of common salt upon the wick of a spirit lamp, and to direct a stream of oxygen gas from a blowpipe upon the salt. The light emitted is quite homogeneous, and of dazzling brightness. If, instead of common salt, we use the various salts of strontian, barytes, &c., we obtain the well-known coloured flames which are characteristic of these substances, with far more brilliancy than by any other method with which I am acquainted."

7. An angular piece of charcoal was placed in the focus of a set of parabolic reflectors, and a stream of electricity directed upon it from a volcanic battery; a light was thus produced of great brilliancy, but of a scintillating, or rather, intermittent description. The same experiment was repeated with a stream of electricity, produced magnetically from Mr. Saxton's magno-electric apparatus,* and with a similar result.

Every experiment made however on this occasion, only served to establish more completely to the satisfaction of every one present, the immense superiority of the *Drummond Light* over all others; and to induce a general feeling of surprise, that no steps have yet been taken to introduce it into any of our light-houses.

N. R.

NOTES ON THE MANUFACTURE OF CHINESE PAPER.

(Communicated to the Society of Arts, by John Reeves, Esq., late of Canton, and published in the Second Part of their Transactions for 1833.)

On the making of Chinese Paper; translated from the twenty-third volume of the Pun Tsaou Kang Muh.

In ancient times, bamboos were connected together, and letters burnt on them, to form books; and hence the several characters employed to denote papers and documents are formed partly with the character for "bamboo."

In the time of the Tsin and the Han dynasties, letters were written upon silk cloth; and hence the characters for silk and cloth are component parts of the character used for paper.

In the time of the Emperor Ho Te (A. D. 100), Tsac Lun began to take the bark of trees, old silk of different kinds,

* United Service Journal, No. 65, p. 464.

* We have been favoured by Mr. Rutter with a drawing and description of a magno-electric apparatus, made for him by Mr. Saxton, which we shall give next week.

fishing-nets, and hemp, and boil them to rags, and make paper of them, which was used throughout the whole of the empire.

Another authority says, the people of Shuh, on the western side of China, use hemp or linen to make paper; the people of the east, in Fokeen, use tender bamboos; the people of the north, the bark of the mulberry; others use the rattan; some, mosses or lichens; some, the straw of wheat or other grains; some, the corcoon of the silk worm; and others, the bark of the choo-tree (syn. of *kuh*), the Brousonettia.

Sha Che, or Crape Paper.

This paper is brought from among the mountains of Nanking, in the province of Tkwang Se.

In spring, during the first and second moons, they take the bark of a tree called kuh-muh (*Brousonettia papyrifera*), and having pounded it, throw it into a stone reservoir of pure water, where they leave it to steep till it is fit for use. They then take it out with the sediment, and pouring it into cow-skin glue boiled with water, stir all together. Taking up this mixture with a mould of bamboo screen of the size required, they put it out into the sun to dry, and it becomes crape-paper.

The Chinese paper called touch-paper (or paper fuel), is made at the village called Peih Keang, a few miles from Canton, of the variety of bamboo called *lang*.

At the beginning of summer, during the fourth and fifth moons, the young sprouts of the bamboo are cut off just as the leaves are beginning to grow, and having been beaten flat, are thrown into a lime-pit to steep for about a month. They are then taken out, washed clean, and dried in the sun. After which they are pounded small, passed through a sieve, and laid up. The kernel of the longan fruit (*Dimocarpus longan*) is also used, being pounded small, dried in the sun, and passed like flour through a sieve. When making the paper, this powder is put into clean water, stirred about, then taken up with a mould made of bamboo screen, and the water left to run off. It is afterwards applied to a heated wall to dry, and the paper is then complete.

For coarser or finer paper a coarser or finer mould is used.

The person who made the drawings says, the bamboo is cut into lengths of about three feet, tied up into bundles of seventeen each, and put into running water, where it stays six months. It is then put (in the same bundles) into pits made in the ground, mixed with quicklime made from the shells of the *Venus sinensis*, pressed down with weights, and left for six months longer. The bundles will have been thus soaked for twelve months; they are then taken out, cut into short lengths, put into one of the usual Chinese pounding-mills, and beaten down into a pulp; being stirred occasionally, so as to present a new surface: about four hours' labour will break it down.

Pits twelve covids deep and ten long contain 2,000 bundles of seventeen pieces each, weighing about 24 catty, or 32 pounds.

Cisterns are about eight covids long, in two partitions, two and six broad, and two pailsful of water are used to one of the pulp.

King Yucca Paper.

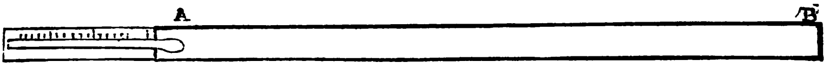
During the fourth moon, at the close of spring and commencement of summer, the bamboo shoots are cut off at the length of three or four covids (14·625 inches), and the size of six or seven inches, and then thrown into a lime-pit to steep for about a month. They are then taken up, washed clean, and bleached every day, till they are of the purest white; after which they are dried in the sun, pounded small, and passed through a very fine sieve, and the finest and whitest part of the powder taken for use. With this is used also the best white cotton of Loo Chow ten times bowed (or bolted), and the very light cotton which is uppermost taken for use.

Rice-water made from the whitest rice being mixed with these two ingredients, the whole is taken up with a mould made of bamboo screen of the size required, and then applied to a heated wall to dry.

This forms the whitest and finest king yuca paper.

The above notes were accompanied by seven outline drawings, made in China, of the various processes of manufacturing paper from the bamboo, which drawings, by the liberality of Mr. Reeves, have been placed in the Society's library.

THE BANNOSCOPE, OR THERMOMETRIC AND PYROMETRIC SCALES IN ONE.



Sir,—I find the following plan, entered in my note-book, of the date Feb. 19, 1833:—*To unite the pyrometric to the thermometric scale, so that the former shall really begin where the latter ends.* A B represents a tube, of crucible composition or of porcelain, and two or three feet longer than the semi-diameter of the furnace for which it is intended. The end B is closed by a plate of porcelain, or of platina, as thin as allowable. The end A admits a thermometric tube. The calibre of the tube is large enough to admit the bulb of the thermometer freely. The tube is exhausted of air as completely as possible, and is closed air-tight. The thickness of its sides also must be twenty or thirty times that of the plate which closes the end B. The end B is thrust into the part of the furnace to be examined; the plate immediately acquires the heat of that part, and as quickly radiates a relative proportion of that heat to the thermometer bulb. A series of experiments, instituted for the purpose, will easily supply the formula to be used in multiplying the indications of the thermometer — experiments, I mean, performed with heats, themselves within the immediate range of the thermometer. This instrument should be called a bannoscope, as it is best calculated for air in large furnaces, such as those of the potteries. It would, however, *bona fide* unite the two scales, and thereby supply the grounds of a more correct estimate in other cases where it could not be used. I am, &c. φ. μ.

REMARKS ON THE AMERICAN METHOD OF WORKING THE PADDLE-WHEELS OF STEAMERS SEPARATELY.

Sir,—Lieutenant Otway, in his Treatise on Steam-Navigation, denies the efficacy of backing one paddle-wheel and pulling the other, as practised by the Americans, and described at page 19 of your present volume. I do not believe two engines will keep time with each other if unconnected at the cranks. I do not deny, however, that the Americans may work theirs so; and it is, certainly, a strong circumstance in their favour, that their making slight variations in the time of the wheels, is a matter of no consequence, and does not produce any deviation from the track of the vessel—at least not enough to cause extra work to the steersman. What is said about our considering in this country the second engine nearly useless when the first is damaged, is not correct, for it very often occurs that a steam-vessel performs nearly an entire voyage with one engine; indeed in rivers, where there is always *smooth* water, a single engine is decidedly best. The "Mountaineer" went from London to Calais many voyages with a single engine. There is no denying, however, that for the *sea and tugging* double engines are best. I am, &c.

W. THOROLD.

Norwich, April 21, 1834.

STRYCHNIA RECOMMENDED, INSTEAD OF PRUSSIC ACID, FOR POISONING HARPOONS.

Sir,—In your Journal of the 12th inst. there is a notice respecting the taking of whales, by poisoning the harpoons by means of concentrated prussic acid, the failure of which I should attribute to the decomposition of the acid. Gay Lussac found that concentrated prussic acid sometimes begins to decompose in an hour after it is made, and that it rarely can be preserved a fortnight. I would suggest the employment of strychnia as a substitute. It is not liable to spontaneous decomposition, and is in a solid form, which, I think, would be found more convenient in practice. If preferred, however, it may be used in solution in alcohol. Strychnia is obtained by treating nux-vomica with *cold* water—evaporating the clear solution to the consistence of syrup—dissolving this in alcohol—evaporating again almost to dryness by a water-bath—dissolving up the igasurate of strychnia by cold water, heating the solution, and precipitating the strychnia by lime-water, when it is dissolved up by boiling alcohol and crystallised. The first solution in alcohol, and the subsequent one in water, are to separate the gum and fatty matter. Strychnia is the active principle of the upas, which is used by the Indians

for poisoning arrows. The action of strychnia is so rapid, that, on poisoning rats and mice with wheat boiled with nux-vomica, I have seen them dead with a grain of wheat in their mouths.

Yours, &c.

W. TEGETMEIR.

London University.

THE LATE WM. SYMINGTON'S CLAIM TO THE INVENTION OF STEAM NAVIGATION.

When noticing in our 19th vol. p. 121, the Memoir of the late Mr. Symington, by his son-in-law, Mr. Bowie, we investigated very fully his claims to the invention of Steam Navigation; and the result of this investigation was a perfect conviction, that to him and no other this great honour belongs. We have reason to know that the view which we took of the evidence on the subject—of that part of it more particularly which concerns the rival claims of Wm. Taylor—has made converts of many who had previously a very different impression of Mr. Symington's merits. We are entitled also to conclude that we made out a case in favour of this ill-requited individual, which if not unanswerable, it is at least not very easy to answer—since up to this time no answer to it has appeared. But there are those, who though they cannot refute a claim, will persist in refusing to acknowledge its validity; some from unwillingness to confess a previous delusion, others from an imperfect perception of what is due to truth, and a few perhaps, because some interest which they prefer to truth, forbids. Among this class—though not certainly in the last section of it—we regret to have to rank on this occasion, the Editors of journals in general so well and uprightly conducted, as "Chambers's Edinburgh Journal," and "Chambers's Information for the People." In an early number of the former periodical, a Memoir of Taylor was given, in which the whole merit of originating Steam Navigation was assigned to him, and the claims of the real originator, Mr. Symington, treated with singular levity; but though the evidence which disproves Taylor's pretensions has been since (as we are informed) communicated to Messrs. Chambers, they have never thought fit to amend their award, and in giving more recently in the "Information for the People," a history of the "Steam Engine and Locomotive Machines," they have omitted all reference to the matter in dispute. They have not, it is true, renewed the claim on the behalf of Taylor, and that is something; but they have failed to do that full justice to *Symington, which we think* truth and candour *require at their hands.*

The document chiefly relied upon in the memoir of Taylor, as establishing his claims to the invention of steam navigation was a letter addressed to him by Mr. Symington, in the following terms:—

Glasgow, Feb. 9, 1821.

"Sir,—In terms of my former agreement when making experiments of sailing by the steam-engine, I hereby bind and oblige myself to convey to you by a regular assignation the one-half of the interest and proceeds of the patent taken by me upon that invention, when an opportunity occurs of executing the deed, and when required, I am, Sir, your obedient servant.

(Signed.) WILLIAM SYMINGTON.

"To Mr. James Taylor, Cumnock."

We were not aware of the existence of this letter, at the time we penned our former remarks. We think it right therefore to take the present opportunity of stating that it does not alter our view of the case in the least, but on the contrary confirms it in the strongest possible manner. Why should Mr. Symington bind himself to assign a share in the patent for the invention to Taylor, if the whole right to it rested with Taylor—which is what Taylor's friends maintain? It could not have been because Symington acquired by any *pecuniary means* an interest in the invention that the patent for it was taken out in his name; for Symington was notoriously and confessedly a person without money. It must have been the *invention* of the thing, and that alone, which constituted Symington's title. The monied person in the business—or at least the person who procured from others the money to take out the patent—was Taylor; he also was the person who introduced Symington to the influential patronage of Mr. Miller of Dalswinton; and it seems to have been on these grounds—partly pecuniary considerations and partly gratitude,—that Symington covenanted to assign to Taylor one-half of the fruits of his invention. If Taylor had been the principal in the affair he would have been the assigning party, and Symington the party to receive the assignment. As it is Symington appears as the principal, and Taylor as a mere auxiliary—which, no doubt, was the relation in which the parties actually stood towards each other.

A portrait of Mr. Symington, engraved from a bust in the possession of Mr. Bowie, will be published next week along with the Supplement to our last volume. It is considered by his family to be a very striking likeness, and has been done great justice to by the engraver, Mr. Roffe.

INQUIRIES, AND ANSWERS TO INQUIRIES.

Division of Circular Bodies.—Sir, A person in my neighbourhood was directed to make a globe of elm of 14 inches diameter, and to divide the surface by boring 14 holes at equal distances. The person employed, finding a difficulty in the division, applied to me. Seeing it to be a practical question, and likely to be of some utility, I submit it to your widely circulated magazine, with a slight alteration. The person employed was instructed to divide the surface into 14 equal *distances*. This being impracticable, I would put the question thus:—How to divide the globe into 14 equal *spaces*? That is, how to find, by calculation and geometrical construction, the radius and number of superficial inches in each circle or space?

Another Question.—Force of the Wind on Flagstaffs.—It is wanted to raise a flag on a pole 40 feet in length, on the outside of a turret of a church. The pole is to be raised 22 feet, and hang upon a rope when in use; the two loops, which steady the pole, are 15 feet apart; the flag 24 feet long by 10 feet deep. *Query*, The force of the wind upon the flag and staff at the velocities of 10, 20, 30, and 40 miles per hour? An apprehension seems to be entertained by some people, that the force of the wind on the flag and staff will damage the turret. It is desired, therefore, to know what pressure may be expected on each of the loops at the aforesaid velocities.—I am, Sir, your obedient servant, WM. ANDREWS, Ivinghoe, Bucks.

Steam Dredging Machines. — Sir,—At a time like the present, when the claims of all having any pretensions to the invention or introduction of any improvement, however trifling, are almost invariably defended by one party and contested by another with great zeal, it appears somewhat remarkable that the honour of having first applied steam-power to the purpose of dredging rivers, &c., has never publicly been claimed by any individual. On looking at the popular treatises on the subject to be found in the more modern cyclopædias, I find the names of those who first employed water-wheels, &c., as at the Pont Neuilly, for the purpose of dredging rivers, but no further mention is made of the introduction of steam than that it was first used in a dredging-machine employed by the corporation of the Trinity House, on the river Thames. The important omission evident in these treatises appears the more remarkable when we find it stated, that all the means used before the application of steam were very inadequate to deepen the beds of rivers, and the operation was always therefore attended with considerable expense. *It is certainly a desideratum in the history of mechanical improvements to be better informed* than we are at present, on many points connected with the introduction of steam as a dredging power, and no vehicle can, in my opinion, be better adapted for the communication of such information, than your valuable magazine. If this hint should be acted upon by any of your correspondents, it will be a source of great gratification to, Mr. Editor, your very obedient servant, D. M.

Lecturing Apparatus.—Whoever has attempted to perform electrical experiments before a numerous company, must have found the difficulty of preventing a deposition of moisture upon his jars, from the breath of the spectators. The plan which I have found the most effectual is, to enclose the jars in a common meat screen, before a fire, till the moment they are wanted. But it occurs to me, that a kind of hot air apparatus might be easily contrived, by means of which a lecture table, and the utensils upon it, might be surrounded by an atmosphere of dry air, which would render the operator independent of the weather, and prevent frequent disappointment. Not possessing myself the requisite mechanical ingenuity, it would oblige me greatly if any of the correspondents of the Mechanics' Magazine should think the subject worth their notice, and am, respectfully, H. WATSON.

Heating Steam Boilers with Gas.—The economical application of gas to cooking, encourages me to hope that it may also be applied to steam boilers, in places where coals are very dear. What, in that case, would be the expense of the gas per hour, for a one-horse engine? If Mr. Rutter can do as much at Southampton, with coke at 25*s.* and tar at 3*d.*, as is usually done with a ton of coals, there would be a saving here (at St. Albans) by the adoption of his process instead of coal, for heating purposes, of nearly three-fourths—for at present Wednesbury coals are selling at 40*s.*, coke at 24*s.*, and tar at 2½*d.* J. F., *St. Albans.*

Dissolving Caoutchouc.—Mr. Williams will find two papers, containing full directions on this subject, in our 371st Number; but lest he should not have it at hand, we shall here state briefly, that by soaking caoutchouc in ether for a few days, it may be moulded by hand into any shape; or still more speedily, by merely softening it in ether, and then treating it with essential oil of sassafras.

Buoyancy of the Gases.—If W. L. T. who wishes to add something in the nature of a balloon to a certain machine, will only consider that the tendency of hydrogen gas to ascend arises from its being lighter than atmospheric air; he will perceive that nothing would be gained by the plan he has in contemplation.

LIST OF NEW PATENTS GRANTED BETWEEN THE 22D OF MARCH, AND 24TH OF APRIL, 1834.

Janet Taylor, of East-street, Red Lion-square, in the county of Middlesex, for improvements in instruments for measuring angles and distances applicable to nautical and other purposes. March 27; six months to enrol specification.

Henry William Nunn, of Whippingham, in the Isle of Wight, bobbin-net lace manufacturer, for improvements in manufacturing certain kinds of embroidered lace. March 27: six months to specify.

James Walton, of Sowerby-bridge, county of York, cloth dresser, for improvements in cards for carding wool, cotton, silk, and other fibrous substances, and for raising the pile of woollen and other cloths. March 27; six months to specify.

John Cooper Douglas, of Great Ormond-street, Esq., for a method of constructing an apparatus or apparatuses, from which a motive principle of power is obtained; likewise for increasing said motive principle, applicable to various denominations of locomotion, and to machinery that is stationary; and also for raising solid and fluid bodies, and various other useful purposes; and also for constructing and forming of apparatus and vehicles to be propelled or worked by means of the said power. March 29; six months to specify.

William Hirst, of Leeds, clothier, for certain improvements in machinery for the better dressing and finishing woollen and other fabrics. March 31; six months to specify.

Hooton Deverill, of Manchester, Gent., for a method of engraving and etching on cylindrical surfaces, for printing and other purposes. March 31; six months to specify.

George Millichap, of Birmingham, carriage axletree manufacturer, for certain improvements on locomotive machines or carriages. March 31; six months to specify.

Herman Hendriks, of the Strand, Gent., for improvements in the process of dying wool and woollen fabrics yellow, being a communication from a foreigner residing abroad. April 8; six months to specify.

Henry Crosley, of Hooper-square, Leman-street, London, engineer, for an improved method or process, arrangement and combination of apparatus, with certain agents used or employed therewith, whereby evaporation of fluids and solutions may be effected advantageously; and also for other beneficial purposes, to which the said method or process is applicable or can be applied. April 8; six months to specify.

Auguste Victor Joseph D. Asda, of Adam-street, Adelphi, Gent., for certain improvements on pumps or machinery for raising water or other fluids, being a communication from a foreigner residing abroad. April 10; six months to specify.

Samuel Morand, of Manchester, merchant, for improvements on his improved stretching machine, for which he obtained letters patent dated the 14th day of April, 1831. April 12; six months to specify.

John Beare, of Pall Mall East, civil engineer, for certain improvements in engines or machines for raising or conveying water or other fluids. April 12; six months to specify.

William Williams, of Pembrey-house, near Llanelly, and Thomas Hay, of Kidwelly tin-works, th in the county of Carmarthen, Gents., for imve ments in preparing certain metals applicable to the sheathing the bottoms of ships and other purposes. April 17; six months to specify

John Henry Cassell, of Mill-wall, Poplar, merchant, for a cement, or combination of materials applicable to the purposes for which cement, stone, brick, or other similar substances may or can be used. April 19; six months to specify.

John Hewitt, of Kenegie, Cornwall, Gent., for a combination of certain materials or matters, which being combined or mixed together, will form a valuable substance or compound, and may be used with or as substitute for soap. April 19; six months to specify.

Juan José Segundo, of Burton-crescent, Esq., for an apparatus or method applicable to side saddles, for giving the security to persons when riding. April 22; six months to specify.

Joseph Shee, of Lawrence Pountney-place, London, Gent., for certain improvements in distillation. April 22; six months to specify.

John Bethell, of Mecklenburgh-square, Gent., for certain improvements in machinery or apparatus for making metal screws, pins, bolts, and rivets. April 24; six months to specify.

NOTES AND NOTICES.

In a lecture on marbles, read last week, by Mr. C. H. Smith, before the Society of Arts, the lecturer was pleased to predict that in less than a century the triumphal arch of the new palace at Pimlico would be in ruins, in consequence of the perishable nature of the Carrara marble, of which it is composed. Mr. Chantry, though he declined to execute the sculpture of this arch, from a feeling " that works of art in marble (of any sort), exposed to the climate of this country, are not likely to be very lasting," did not assign to it so short a date as Mr. Smith. When examined on the subject by the Committee of the House of Commons, he stated that " the construcution and material are such that the arch will remain for a long period, though *a few hundred years* will obliterate much of its ornamental parts." It is also due to those who selected Carrara marble for the purpose, to add that they did not do so without having as much regard for its durability as beauty. " I have consulted the King," said Mr. Nash, in a letter to Mr. Brown and Sir Chas. Long, the eminent scagliola manufacturer, who was sent out to Carrara to purchase the marble in question, " and we have come to a resolution to have the whole of the arch of the ' ordinary marble,' which you recommend, but remember I rely on what you say of the marble, that it is *more durable than any stone we have here, except granite.*"

The letter to " Endeavour" is forwarded. The " deficiencies" alluded to can probably be all supplied.

Communications received from Mr. Whitelaw—M. R. J. G.—Mr. Willan—Z.—A Subscriber (Liverpool)—Mr. Mackinnon.

The Supplement to our last Volume, containing Tables of Contents, Index, &c., with a Portrait, on Steel, of Wm. Symington, the Inventor of Steam Navigation, will be published on the 1st of May.

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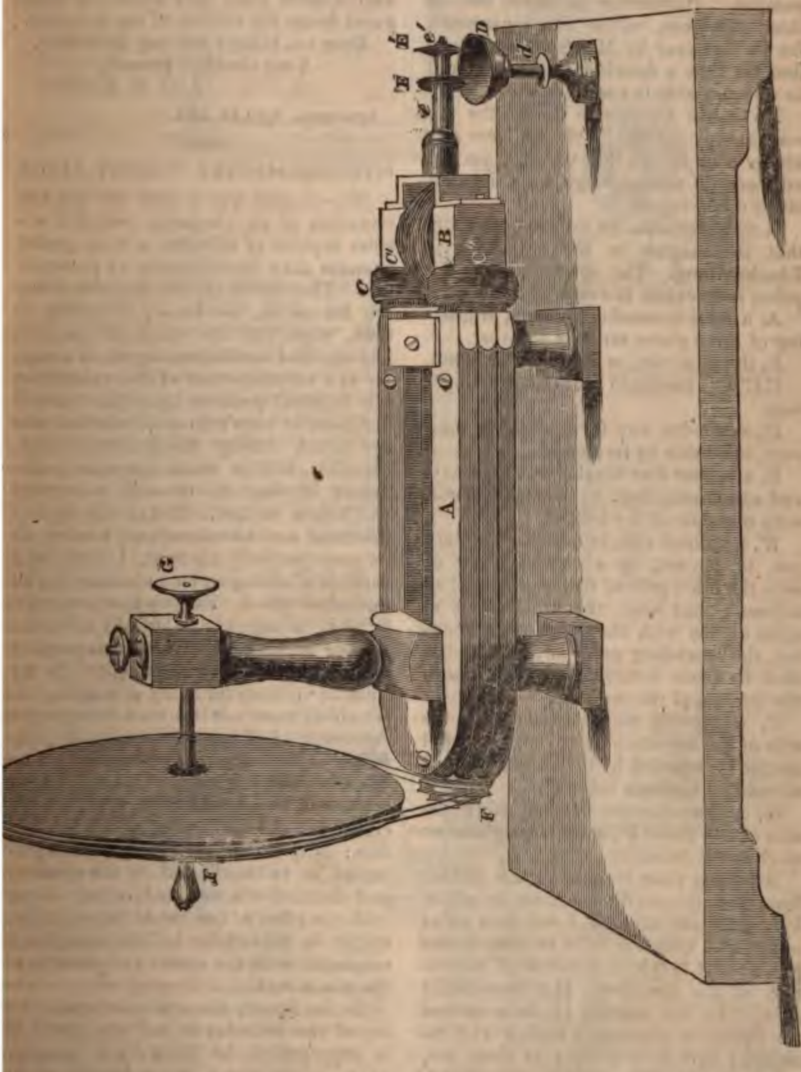
SAXTON'S MAGNETO-ELECTRIC APPARATUS.



SAXTON'S MAGNETO-ELECTRIC APPARATUS.

Dear Sir,—In a review of Mrs. Somerville's excellent work "on the Connexion of the Physical Sciences" (Mech. Mag. No. 555, page 446), I have noticed an extract, in which that lady describes the recently invented magneto-electric apparatus. Happening to have one of these machines, which was constructed for me last year by Mr. Saxton, I have thought that a drawing of it might not be unacceptable to your readers.

No thanks are due to me for the accompanying sketch. A friend here has kindly done for me that which, I am not ashamed to acknowledge, I am incapable of doing myself.

It may, perhaps, be necessary to state, that the magnet in my apparatus is 7 inches long. The space between the poles, from centre to centre, 2 inches.

A, a steel horse-shoe magnet, consisting of three plates screwed together.

B, the armature, or keeper, of soft iron.

C C′ C″, insulated helices of copper wire.

D, a wooden cup for containing mercury, moveable by its stem *d*.

E, a copper disc dipping into mercury, and communicating, by a brass socket *e*, with one pole of the helices.

E′, a pointed slip, or cross-bar, of copper, in contact, by a central screw *e′*, with the other pole of the helices, and so adjusted that when the armature is at right angles with the poles of the magnet, the ascending point of the cross-bar shall be about 1-20th of an inch above the surface of the mercury.

F, a grooved wheel fixed upon the axis of the armature B, to which rapid motion is imparted by the larger grooved wheel and leathern band F′.

G, a thumb-screw for adjusting the axis of the wheel F′, so as to tighten or slacken the band.

Referring your readers to the extract from Mrs. Somerville's treatise, to which I have already alluded, I will just point out what I conceive to be an error in one part of that lady's description of the action of this machine. Mrs. Somerville says, "by the rotation of the armature the circuit is alternately broken and renewed; and as it is only at these moments that electric action is manifested, a brilliant spark takes place every time the copper point touches the surface of the mercury."

It will readily be perceived, I think, by those who are acquainted with the subject, that the spark cannot take place when the point *touches* the surface of the mercury. The spark is indicative of the renewal of the interrupted circuit, and it takes place only when the copper point *leaves* the surface of the mercury.

Dear sir, believe me very faithfully,
Your obedient servant,
J. O. N. Rutter.

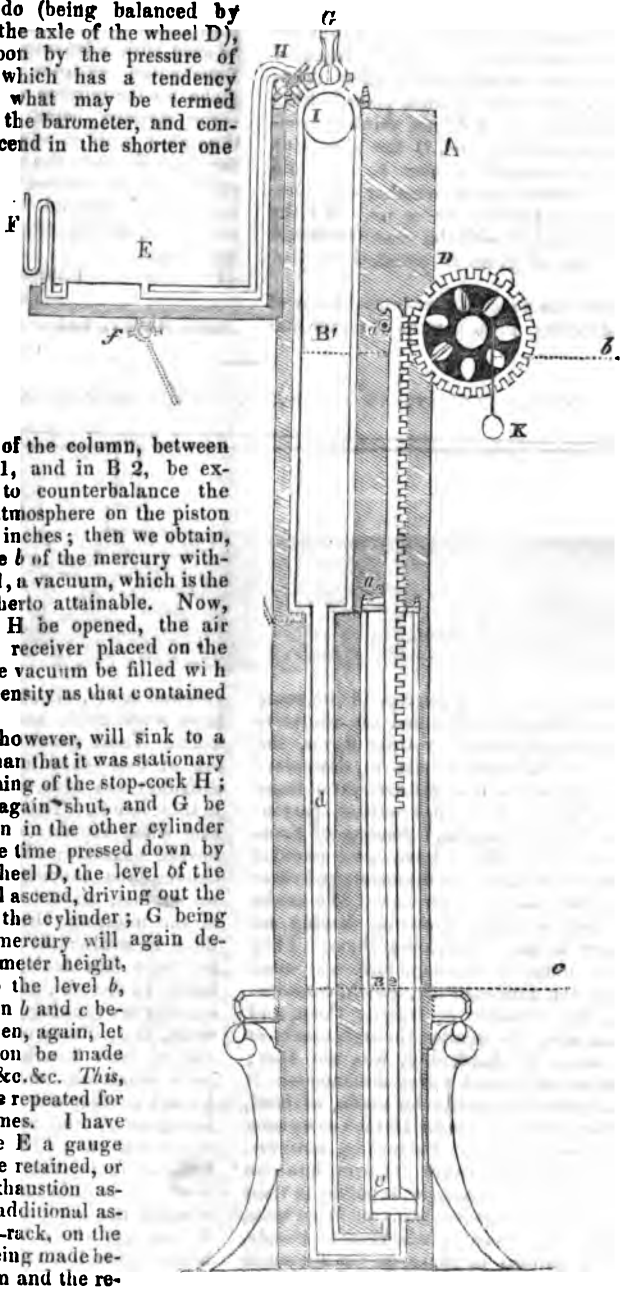
Lymington, April 16, 1834.

EFFECTIVE AIR-PUMP WITHOUT VALVES.

Sir,—I send you a plan for the construction of an air-pump, which I consider capable of effecting a more perfect vacuum than the apparatus at present in use. The valves in the common pump are incapable, we know, of acting as such, when the air within the receiver has attained a sufficient degree of rarity; for at a certain period of the exhaustion the external pressure upon the valve is sufficient to keep it in close contact with the piston during its descent, which, therefore, acts in some degree as a condenser of what its upward movement had before rarified. But in my apparatus there are no valves, and having all its parts perfectly air-tight, I consider it capable of acting as an exhauster for an unlimited period. That its plan is simple, is plain to any one who will take the trouble of inspecting the accompanying figure, but not the less effective, in my humble opinion, for being so simple. It is neither more nor less than bringing a succession of Torrecellian vacuums, obtained by a large barometer, to act on the air in the interior of a receiver, by making a communication with the receiver and the vacuum after its production: this, in the figure, I have represented as to be effected by the opening and shutting of a stop-cock, which, along with the other at the top of the cylinder, might be moved by a little machinery connected with the ascent and descent of the piston-rack.

In the figure, the space between the top of the cylinder B and the piston C is supposed to be filled by a column of mercury, which has a height of 50 inches. Now, if the piston C be al-

lowed to ascend, which, when left to itself, it will do (being balanced by a weight K on the axle of the wheel D), when acted upon by the pressure of the mercury, which has a tendency to descend in what may be termed the long leg of the barometer, and consequently to ascend in the shorter one



until the height of the column, between its level in B 1, and in B 2, be exactly such as to counterbalance the weight of the atmosphere on the piston in B 2, about 30 inches; then we obtain, above the surface *b* of the mercury within the cylinder B1, a vacuum, which is the most perfect hitherto attainable. Now, if the stop-cock H be opened, the air will rush from a receiver placed on the plate E, until the vacuum be filled wi h air of the same density as that contained in the receiver.

The mercury, however, will sink to a still lower level than that it was stationary at before the opening of the stop-cock H; if, then, H be again shut, and G be opened, the piston in the other cylinder being at the same time pressed down by the rack and wheel D, the level of the mercury in B will ascend, driving out the air contained in the cylinder; G being then shut, the mercury will again descend to the barometer height, which will be to the level *b*, the height between *b* and c being 30 inches: then, again, let the communication be made with the receiver, &c. &c. *This*, it is plain, may be repeated for any number of times. I have added to the plate E a gauge F, which may be retained, or the degree of exhaustion ascertained by the additional ascent of the piston-rack, on the communication being made between the vacuum and the re-

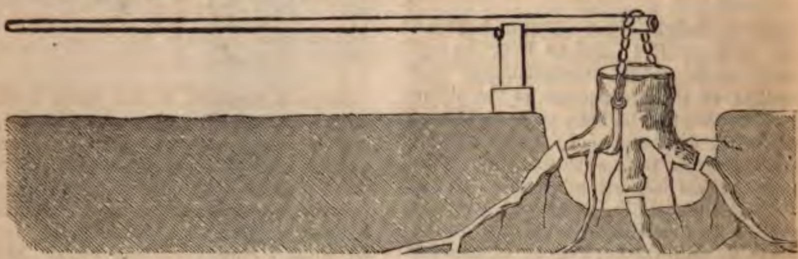
ceiver. The round body marked I, was intended to represent a glass globe, which being fitted perfectly air-tight within the cylinder, would prevent the acid fumes of any substance which would affect them, acting on the mercury when placed within the receiver; but I do not think it absolutely necessary; and if the apparatus were constructed without it, it would then not matter much, whether the cylinder were a perfect one or no. All the parts in contact with the mercury should either be of glass or polished steel or iron.

As to the possibility or impossibility of constructing an apparatus of either material, I cannot speak. A tube between *f* and *g*, communicating with the plate E at *f*, and with the tube *d d* at *g*, might be used with advantage in procuring a Torrecellian vacuum within a glass globe, for the purpose of weighing gases—the mercury being forced from *d d* through *e*, until it attained the level of the plate E; then the globe full of mercury might be screwed on, and the mercury would descend from the globe in the tube *e*, until it attained the barometric height.

I am, sir,
THOS. H. ROWAN.

Dublin, March 15, 1834.

PRACTICAL HINTS TO EMIGRANTS, ON THE CLEARING OF LANDS.



Sir,—One of your correspondents, some time back, recommended circular saws for cutting timber or trees down, the saws to be about 4 feet in diameter! You published also an account of some machines for horizontal cutting, patronised by the Highland Society of Scotland. Now, sir, I have some circular saws, of 30 inches in diameter, and these are the largest I ever saw. We make no use of them, however, having no power to spare for driving them. They were made in London, and cost more than ten guineas each, which, considering the difficulty of making them, and that many are spoiled through cracks or flaws in the hardening, was not dear; but as for saws of 4 feet diameter—it is not likely they could be made, or used, when made, as even 16-inch saws soon heat and buckle. Supposing, however, these difficulties were got over, how can poor colonists—some with not 5*l.* in their pocket—be expected to lay out 10 guineas, or more, for sawing machines? People, *with guineas to spare, go* not abroad to *fell woods. The men that* do go are the poor and needy, who, if they would thrive, must work hard, and not stand upon trifles. There must be no staying for this or that—they must make the best shift they can with what comes readiest to their hands. To illustrate what I have said about circular saws, take the following example:—When, in 1803, the Golden-lane subscription brewery was set on foot, an old shopmate of mine, of the name of Green, was employed there as millwright. Having occasion for some thin deals, but none being at hand, he thought, as they had a 2-feet circular saw running, and plenty of 3-inch deals, that, if they put two cuts through one of these 3-inch deals, they would have what was wanted. Accordingly, he and another man set the saw to work, laying on all the power of the engine, which was one of 12 or 16-horse power; but they found that if they pushed the deal ever so little too fast, it completely stopped the engine. Now, if cutting a 3-inch deal with a 2-feet saw stops a 12-horse engine, how will two poor men work a 4-feet circular saw? No, my emigrant

friends, if you have the means of taking out a few tools with you, let them be of the simplest and cheapest sort; such as a good axe, a hand-saw, a cross-cut saw (for if two men, or families, unite, they may cross-cut a tree down in less time than by chopping)—a spade, with pick-axe and crowbar, gimblets, nails, two or three augers, mortice chisels, &c., not forgetting that most useful of all tools, a grindstone, and two or three triangular files (*vulgo*, three squares), for sharpening your saws, or they will soon be as useless as a gun without a lock or flint. No time the first year to grub up roots; enough to do to raise, with spade labour, a crop of potatoes, corn, &c. Let the roots rot, or try to burn them in their places, as I have seen German colonists do. When time admits, the following very simple mode of extraction may be adopted. After removing the earth from around the main stump, and cutting the principal branching roots quite through, take a long, slender tree, like a scaffolding pole, such as two persons can lift, as a lever; hang two strong hooks, with a bit of chain-cable from the short end of this lever; attach these hooks to the under end of the stump; place an upright support at a little distance from the stump, to serve as a fulcrum—(all as represented in the prefixed rough sketch)—and then pull away at the lever with all your might. This will be found a far more simple method than any of the expensive ones recommended by the Highland Society, or others, and, I doubt not, equally efficient. It would be as well, however, to consider, before cutting some trees down, whether the tree itself might not be made a lever of to extract the roots. Fir trees, and several others, project their roots but a little way from the surface of the ground, so that, by digging a little round the roots, and cutting through the large fibres, many might be pulled down by means of a rope fastened to the top.

I hope some of your more able correspondents will pursue the subject; for when the poor emigrant is far away from help, things do not always turn up so pleasantly as they did with that prince of colonists, Robinson Crusoe.

I am, sir, your obedient servant,

WM. REED.

Peterhoff Paper-Mill, near St. Petersburgh, Jan. 1834.

TWIN PASSAGE-BOAT FOR CANALS.

Sir,—It occurred to me when I was writing the concluding paragraph of my last letter to you, that twin passage boats having the form shown in the above sketch (which is a top view) would send no waves towards the banks, and might be used to advantage on canals that had no stone facing along the sides. The two outside surfaces of the boats are straight and parallel in the direction of their length, but may be curved, like any other boat, from the top edge downwards, and the two interior sides must have the gig-shape as nearly as possible. The two cross pieces connect the boats, and the tow-line is fixed to the part running up the centre. Any wave that is formed between the boats will settle at the stern, and act in the same way as the wave in the case of the Paisley canal passage boats; and the parallel outside surfaces of the boats can raise no wave. I made a model, 5 feet long, with the other dimensions in proportion, to try its effect, and when it was drawn through the water at the best velocity, the water all around was *perfectly* smooth, although there was a large wave formed between the boats. The wave commenced a little behind the bow, and it was level with the surface of the canal before it reached the stern; if the curved sides of the boats had been out, this wave would have been driven to the banks of the canal.

As twin-boats are not likely to upset, they may be built very narrow, and not take up much room in the breadth of the canal, if their draught of water is increased. Part of the deck that holds the boats together may be formed into seats, and all the passengers may sit with their feet down into the boats, and their faces towards the banks of the canal. The centre part of the deck may be used for walking upon, as the passengers, when standing on it, will be high enough to see over the awnings that cover the cabins. At places where the deck, for the sake of binding the boats more firmly together, must stretch from outside to outside, doors may be left from the deck to the cabins. As no waves *leave* a boat of this sort, it certainly must take less power to work it, on which account, I think the principle may be applied to little sailing-craft, such as pleasure-boats. The waves that are formed by the *paddle* of a twin steam-boat might be got quit of by forming the stern properly. In my model, the outsides were plain and parallel in the up and down as well as in the length direction.

I am, sir, yours truly,

JAMES WHITELAW.

Glasgow, April 18, 1834.

FARTHER PROOFS THAT THE NOTION OF WAGES BEING LOWER ON THE CONTINENT THAN IN ENGLAND RESTS ON INSUFFICIENT EVIDENCE—drawn from a comparison of the rates of payment for cotton work done in different English mills.

(From Preface, by John W. Cowell, Esq., to Tables relative to the Cotton and Silk Mills in the Lancashire District, contained in Supplementary Report of the Factory Commissioners.)

The opinion that wages are so much higher in England than elsewhere, and consequently that our manufacturers labour under such peculiar disadvantages compared with foreign manufacturers, is most deeply rooted.

And as it may be supposed by some, and will be asserted by others (unless the principles on which the following Tables have been constructed are thoroughly understood), that the results displayed in them are confirmatory of such opinions, it is necessary to show that they afford no evidence which legitimately supports them, and likewise that they sufficiently prove that no elements exist any where on which a correct comparison between the rate of wages in foreign and domestic cotton-working can be founded.

I venture to say, not only that no evidence exists to justify the assertion that the rate of payment for "work done" in the cotton manufacture is lower abroad than in England, but likewise that no means exist for comparing in general the rates between any two places in England itself, and that it is exceedingly difficult to compare the rates of payment for "work done" in any two mills.

In order to avoid the appearance of confusion between conclusions strictly referable to the rate of payment for "work done," and others referable to "interest on fixed capital or rent," I will select a particular mill (that of Mr. Ashworth) to illustrate my position.

The machinery in Mr. Ashworth's Egerton Mill is of the newest and most beautiful construction. He told me that were he to fit it up again to-morrow he could not improve or economise upon it in any respect. All the mules carry the same number of spindles, viz. 512, and each spinner spins upon two at the same time, having three juvenile assistants; consequently four persons manage 1,024 threads. So steady is the action, and so well is the friction managed, that an operative can spin as many threads in a given time on these large and heavy machines as he could on lighter ones of an older construction. I timed the action of several of them (the moving power working at its average speed) with a timepiece, as I did in most of the mills which I visited, and I could not perceive that they consumed a greater number of seconds to produce one crop of 512 threads (technically called "the stretch"), than smaller machinery. I examined several spinners in the mill of different degrees of skill on this point, and they did not represent that any time was lost in consequence of the magnitude of the machinery. On the day that I visited the mill they were spinning twist of the fineness of from No. 70 to No. 80, and the different spinners variously spun from 1,400 to 1,600 double sets or "stretches" of threads a day of that quality, of 1,024 threads the "stretch," according to their different degrees of skill and capacity. The length of each "stretch" of thread spun by one effort of the machine was 59 inches.

Under these circumstances the spinners were receiving from 46*s*. to 53*s*. a week, according to their skill, of which each had to pay 16*s*. among his three assistants, leaving his own net earnings varying, according to his skill, from 30*s*. to 37*s*. a week.

In the first place, the length of each thread given by one effort of Mr. Ashworth's machines is 59 inches; this is 5 inches more than that given by machines in general use. Each spindle, therefore, gives 5 inches

greater length, and works (let it be supposed) 1,500 times in the day; therefore it gives (in round numbers) 200 yards of twist per day more than is given by an ordinary spindle. Each pair of mules, consisting of 1,024 such spindles, gives (in round numbers) 200,000 yards of twist more per day than is given by mules of the average perfection; and this immense advantage arises but from one element, among several others, of superiority in Mr. Ashworth's machinery. The advantage of this is of course divided between the master and his operative. He pays his operative at a lower rate for work done than if the spindle produced 200 yards less per day than it does, and his operative still earns a greater sum of money at the end of the week than if he were working with machinery which would only yield a thread 54 inches long.

How, under these circumstances, would it be possible for Mr. Ashworth to know whether he was paying a higher or a lower rate of wages, or carrying on his business at a higher or lower cost, in this particular, viz., for "work done," than any given mill-owner at Manchester, Stockport, Oldham, Bury, or any other place in the neighbourhood, unless he knew regarding such mill all the particulars that I have detailed regarding his own and sundry others besides? Nay, what is still stronger, Mr. Ashworth would have great difficulty in accurately fixing what rate of wages any spinner in his mill was really receiving, unless he made a minute investigation.

For, taking round numbers for facility, let us suppose that it cost Mr. Ashworth 30,000*l.* to build his factory, and fill it with machinery; let us suppose that it contains 30,000 spindles, and that he employs thirty spinners, each having 1,000 spindles to watch; we may then consider him as dividing his factory into thirty shops of the value of 1,000*l.* each, and entitled to expect the same return from each. Let us suppose the return that he expects from each is 250*l.* per annum, composed of

5	per cent. for	interest.
5	ditto	wear and tear.
15	ditto	profit.
25	per cent.*	

But if we suppose this to be the *maximum* amount which each shop of 1,000 spindles is capable of yielding, it would only be yielded by those worked by the most skilful operatives.

We have seen that the skill of the operatives in his employ varies as 7 : 8, consequently the shops worked by the least skilful operative would only yield seven-eighths of 250*l.*, or 218*l.* 15*s.*

Now, by the supposition, each of the thirty shops is of precisely equal value, as far as fixed capital, excellence of machinery, and cost of working is concerned.

Thus we perceive that the cost of production of a given pound of twist would be greater or less according as it came from the shop having the most or the least skilled operative attached to it; and as all the other ingredients in cost of production, except wages (or rate of payment for work done, if these two things are to be confounded,) are invariable according to the supposition, this difference in the cost of producing a pound of yarn evidently arises solely from that different rate of payment for quantity of work done, to which he is forced to submit, in consequence of the different degrees of strength and skill which his operatives possess. But his profit would be greatest from the twist spun by the operative who netted 37*s.* a week, and least from that produced by the one who was only capable of earning 30*s.* a week, *and he would be paying for the work done by the former at a lower rate than for that done by the latter, though the earnings of the former would be greater.*

For, as the skill of the operative varies as 7 : 8, the spindles of one shop would yield 800 pounds weight of yarn during the same number of hours consumed by those of the other in yielding only 700. Hence it is clear that the cost of production of every pound of yarn coming from the latter shop would be higher than that of the pound of yarn coming from the former, and equally clear that this is owing solely to the higher payment for work done in the one case than in the other, and not to any other cause. Now, if in our conception we unite the spinner with the spinning-machine, and consider them together as forming one machine, we have thirty systems of spinning-machines built at the same cost, carried on at the same charges of merchandise, the productive powers of which vary from seven to eight in consequence of the variation in the action of the intelligent portion.

Now, though the intelligent agents (the spinners) differ in degrees of skill, yet these differences are as nothing compared with the variations in the productive power of the rest of the machine, of which I am now considering the spinner to form a part.

These variations admitting of measure-

* These figures and proportions are entirely suppositions. I know how many spindles Mr. Ashworth possesses, and his own kindness led him to tell me the actual cost, &c. of building and setting to work his factory.

ment, the mill-owners have adopted scales of payment for work done, varying with (though not *as*) the degree of productive power of the machine on which it is done These scales are printed, and I have given specimens of two of them; but every mill-owner, as far as my experience extends, re-adjusts the public and printed scale according to the actual status of improvement temporarily existing in his own mill. One house, for instance, pays 2*s*. 5*d*. a lb. for yarn of the fineness of 200 hanks to the lb., spun on machines of the magnitude of 648 spindles; another pays 2*s*. 8¾*d*. a lb. for the same quality spun on machines of the same magnitude. The two mills in which these two discrepant rates prevail are in the same town; the operatives of both mingle together every evening after work is done; the weekly net earnings obtained in one mill are several shillings a week greater than those in the other; the fact is notorious among all the parties interested, but is submitted to, and allowed to be equitable, because one mill is, in certain respects, under disadvantages as compared with the other.

Hence we perceive that the rate of payment for work done is regulated by two scales. That which is referable to the productiveness of the machine admits of measurement,—is exhibited on paper,—and re-adjusted in each mill respectively; while the other, which does not admit of exhibition on paper, is practically measured by the comparative skill of each operative, and exhibits itself in the quantity of work which he is able to turn off from a machine of given productiveness in a given time.

Now, if we consider the spinner and his machine as making one system, these two scales would be amalgamated into one, according to which the master would estimate his rate of payment for work done, and we should then be able to obtain something that resembles accuracy in comparing what is commonly called the rate of wages in two mills, two places, and two countries.

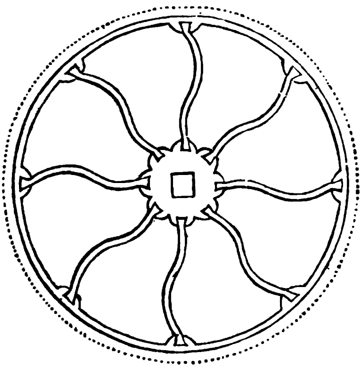
The varying skill of the operative, infused into a machine of given productiveness, would immediately affect that productiveness with its own variations. The spinner whose skill is represented by seven, when attached to a system of 1,000 spindles, would give a productive machine the efficiency of which would be represented by 7,000, while the spinner whose skill is represented by eight, attached to a similar system of 1,000 spindles, would give a machine the productive power of which would be represented by 8,000. Every element in the cost of setting to work the two systems would be the same, yet one would only yield 7,000 threads, while the other would yield 8,000; therefore each thread which the latter produced would be given at a less comparative cost of production than the other. This less comparative cost of production evidently arises from the difference in the skill of the intelligent agent, and consequently attaches to that part of the cost of production which is commonly denominated wages of labour, and more correctly "rate of payment for work done." If we now retrace our steps, disengage the spinner once more from the machine, and then proceed to regulate his remuneration by the productiveness of the machine on which he works, (and this is the principle adopted in the cotton trade,) it is clear that the "rate of payment for work done" will be highest where the skill of the spinner does not enable him to produce more than 7,000 threads in a given time, and lowest where he produces 8,000 in the same time.

From these considerations it appears to me to be clear that the rate of payment for work done can never be known, either particularly or generally, unless the productiveness of the machine, or of machinery in general, is known. This may be arrived at with accuracy in particular instances, and the acquisition of proper data would enable us to throw a certain general light upon the general question, but of what nature I am unable to say. At present it seems to me, from the foregoing analysis, that in occupations dependent on machinery of such a kind as is used in cotton-spinning it is impossible to make any such comparison.

EXPERIMENTS ON WHEELS WITH STRAIGHT AND WITH CURVED ARMS.

Sir,—Having read some remarks, by two or three of your correspondents, in regard to springs as applied to locomotive engines and other heavy carriages, and noticed the suggestion thrown out, that the spokes or arms of the wheels might possibly be made of such materials, and of such a form, as of themselves to counteract sufficiently the jolting of the superincumbent and progressing weight, and so dispense with the costly springs at present used, I am induced, by the perusal of these speculations, to send you an account of some experimental observations of my own, which have, I think, a strong bearing upon the subject. About five years ago, I fitted up some waggons, for a coal concern which I have the management of here, to run upon a railway of cast-iron. The wheels are of cast-iron, but have *wrought*

iron arms, in the form and manner following:—



In giving this curved form to the arms, I did not at the time contemplate that they should act as springs; though, as will be presently seen, it has been attended with great advantage. The ordinary weight of these waggons, when full of coal, is about 3 tons 15 cwt., waggon included. On this same rail-road, an iron company have the privilege of conveying their iron ore, the waggons employed for which purpose are entirely of cast iron, with straight arms, and when loaded weigh (waggon included) something less than 3 tons. In the course of last summer, I found it necessary to repair a wooden bridge of considerable extent, over which both kinds of waggons had to pass, during the time these repairs were going on. To the great surprise of the workmen, they found that our own waggons, although the heavier, as above stated, produced less effect on the bridge than the others. This I could only attribute to the difference in the form of the arms of the wheels; and every observation which I have since made serves to confirm me in this conclusion. I have rode alternately on both sorts of waggons, when at their greatest speed, and certainly a sensible difference is felt to the advantage of the crooked and slender arms. The noise also which they make is much less. It may be proper to add, that the wheels with the wrought iron arms stand their work uncommonly well—much more so than the others. The fact is, we have not had one broken or worn out during the five years that they have been in constant use.

Should this article have the effect of turning the attention of some of your ingenious readers to the subject, it might be of service. Our wrought iron arms are 5 inches wide, and scarcely $\frac{3}{8}$ of an inch thick. Supposing, then, that, instead of being of wrought iron, they were made of steel of suitable quality, they might be made thinner than $\frac{3}{8}$, and with a greater number of arms: a much better form of curve, too, than that I have employed might very possibly be suggested. I am, sir,

Yours respectfully,
Wm. Brough,
Mineral Surveyor.

Cwmneath, Glamorganshire, Dec. 15, 1833.

"THE LIBRARY OF POPULAR INSTRUCTION." *

"In offering this Library to the British public, the proprietors beg to remark," in the preface, "that they have been induced to enter upon its publication partly in consequence of the extraordinary success which has attended the 'Bibliothéque,' published by some of the most celebrated men in France, but principally from the conviction of *the necessity of a similar work in England*." They then proceed to state, that they shall draw largely from the "Bibliothéque Populaire" aforesaid, as a "parent stock." We are reminded by this of an ingenious friend of ours, who once, from the "conviction of the necessity of some similar dish" in England, tried with all his might to introduce to the palates of our benighted countrymen the favourite French regale of "*Ros-bif à l'Anglaise*." (We may mention, by-the-bye, that he failed, chiefly owing to his want of caution, in committing the preparation of the delicious novelty to the unscientific hands of an English cook.) Who that knows any thing of the "Bibliothéque Populaire," does not know that it takes its origin from the extraordinary success which attended the "Library of Useful Knowledge," published by "some of the most celebrated men in England," and

* The Library of Popular Instruction, comprising Elementary Treatises on Scientific Subjects, divested of technicalities, and adapted to all degrees of intelligence. Edited by Dr. J. P. Litchfield. Vol. i. Sparrow and Co.

"from the conviction of the necessity of a similar work in France?" After this, we may expect in a few weeks to see a translation of "Litchfield's Library of Popular Instruction" announced at Paris, while, perhaps, Dr. Litchfield (if there be such a person) will find a relaxation from his more serious labours, in favouring us with a few excellent novels, such as "Waverley," "The Bride of Lammermoor," &c., from the French of M. Defauconpret!

Our national pride was, in fact, a little shocked at the first announcement of this work. It is well known that the French assume to themselves, as a nation, the power and privilege of bringing every thing into fashion. What, they say, was the Newtonian system when buried in "Newton's Principia?" A scientific hypothesis, known only to the learned. It was the lively and ingenious letters of Voltaire that first brought it fairly into public notice, and gave it such credit that now-a-days the veriest dunce in Europe would as soon dream of denying that he sees with his eyes, as that the planets obey the laws of gravitation. In the same manner, the Revolution of 1688 was an event of which no one took notice but those whom it immediately concerned, and liberty was regarded as a mere English whim, as peculiar to the climate as the fogs, and as little worthy of being envied, till the French, by taking up the idea, at once created a new era in the history of the world, and set the mouths of all the other nations watering for a taste. To us this pretension of our once *lively* but now *deadly* neighbours seems a little arrogant, and one which we were indignant that an Englishman should in some degree support, by translating their cheap treatises on the sciences imitated from our own. The inspection of Dr. Litchfield's work, however, has convinced us, that in suspecting his patriotism we did him great injustice.

The fact is, that this "Bibliothèque Populaire" is published by a French society for the diffusion, &c., and Dr. Litchfield, aware of the ridicule which the members of our own association have drawn upon themselves by their pomposity and their blunders, and knowing that many of us were apprehensive that, if their publications should by chance fall into the hands of intelligent foreigners, some portion of the ridicule might be thrown upon us as a nation, has evidently undertaken this work for the benevolent purpose of putting something into our hands to throw in foreigners' teeth in return, and proving, in an unanswerable manner, that in whatever latitude and longitude such societies are found, they have a natural and inherent tendency to make themselves ridiculous. Such, we conceive, is the only tendency of this well-meant publication, for we cannot conceive for what other purpose such a mass of blunders and *niaiseries* (we must borrow the French term, or coin a new one—boobifications) can have been offered to the notice of any public, however indulgent.

The first number of the work, or, as it is called, the first *volume*, contains, "the Elements of Knowledge, being an Introduction to the various branches of Science and the Arts." Our readers may be surprised, after this statement of its contents, to learn that it consists of no more than eighty-four pages, title-page, preface, and so on inclusive; and that these eighty-four pages are so widely printed, that they contain, we should imagine, much about the same quantity of matter, if so much, as the thirty-two columns of a number of the "Mechanics' Magazine." Into this small space the writer proposes to crowd an introduction to all the arts and sciences—the whole "Elements of Knowledge;" and what is still more surprising, evidently without ever having studied the elements of knowledge himself! The name of the distinguished foreigner who is the author of the present number is not divulged in the course of the work. We should think, from internal evidence, it must be *aut Wilhelmus von Turk aut Diabolus.*

The advantages of knowledge are first stated, and short biographical sketches are given in illustration, from which we learn, to our amazement, that "Watt discovered the elastic properties of steam." Unluckily we are not told in what year before the Christian era, but, as he was the discoverer, it must, of course, have been prior to the times of Hero of Alexandria, or any other of the ancients to whom the honour has been hitherto attributed. "He then sought," we find, "to apply this knowledge to the mechanical arts, and constructed the steam-engine—a machine attended with immense effects," the like of which,

we presume, had never been heard of before! It is satisfactory to learn that Watt acquired a trifle from the immense effects which his steam-engine produced, for we are next told, that "he died worth *several millions* of money!!!"

To these expositions of the advantages of knowledge succeeds a general view of the sciences; which convincingly exemplifies, that the study of them is in all respects one of "things, not words," by such "solid lumps" of information as the following:—"The principal parts of the human body are the bones, muscles, nerves, vessels, and entrails. Their study is accordingly divided into Osteology, Myology, Neurology, Angiology, and Splanchnology."—(Page 25.) Something at once amusing and instructive this. This is anatomy—and the other sciences are anatomized in much the same manner. In the midst of all this pith and marrow of science, however, we occasionally meet with a passage or two of less profundity. For instance, at page 43, where Zoology is treated of (and its divisions into Ornithology, Erpetology, &c., of course, duly commemorated), we find, that "the animals usually bred are oxen, *sheep*, goats, horses, pigs, and *lambs*: to these may be added bees and silkworms; and, *after them*, the animals which are used in hunting or retained for pleasure, such as the dog, the falcon, the canary, the parrot, the monkey, &c. It is probable that many animals and birds may be obtained from other lands and domesticated in this country, with immense advantage to the population." We think so, indeed; we could ourselves suggest the introduction of geese, fowls, ducks, turkeys, and rabbits, to say nothing of calves, kids, and colts.

Having now presented our readers with a few of the sweets of the work, culled here and there for his especial detestation, we shall offer to his notice one complete article on the subject of languages, and take the liberty of subjoining a few remarks of our own:—

"The principal dead languages are Latin and Greek (which are still studied in most schools of Europe), Hebrew, ancient Arabic, and Sanscrit."

In this sentence there is unfortunately a slight mistake, which is, that that "principal dead language," ancient Arabic, is alive, and spoken over a good portion of Asia and Africa. The modern language has indeed dropped some of the idioms to be found in the "Koran," and other ancient works, but is neither dead nor buried. To proceed,—

"The most useful modern languages are, French, English, German, Spanish, Italian, Russian, Hindostanee, and Chinese."

And where, pray, are Dutch, Portuguese, Arabic, and Persian; or, since Hindostanee is admitted, Malay and Burman, and a dozen others? It seems rather odd, too, to find the Chinese, a language that is probably not known to a hundred men in Europe, set down as one of the "most useful in the world." Again,—

"A knowledge of foreign tongues is useful in most cases; for example, in travelling, in foreign correspondence, in referring to foreign literature, in history, and *in scientific and useful discoveries*. Formerly the learned treatises were almost always written in *Latin*, and even this language is sometimes employed *for the purpose*. From the Greek are derived nearly all the terms employed in Botany, *Zoology*, and *Mineralogy*.

"The study of languages is effected by means of grammars, and dictionaries. It has been proved, *by careful calculation*, that all the languages in the world result from one common source, whose seat was probably in the East. Formerly many languages were distinguished as parent tongues; at present they are regarded only as sisters, elder and younger, each derived from the parent stock, which is extinct."

Even as we trust the parent stock of the "Library of Popular Instruction" will be extinct in a short space of time, and the scion into the bargain. We shall make no remark on the latter part of this erudite article on languages, but earnestly request the editor to inform us where we may find the "careful calculations," (probably made by Babbage's machine,) in which it is so satisfactorily proved that English, Hebrew, Chinese, and Cherokee, all "result from one common source."

So much for the "Library of Popular Instruction." We have not seen the "Bibliothèque Populaire," but the "Elements of Knowledge" might more properly be entitled "Elements of Ignorance," whether the original composition of "Dr. J. P. Litchfield," or (as the bad English of some of the passages leads

us to suspect, and as the prospectus hints) translated from the French of—

"M. Arago, J. P. de Beranger, Duke de Bassano, Count Alex. de la Borde, F. Cuvier, E. Duchatalet, C. Dupin, Guy Lussac, M. Geoffroy St. Hilaire, De Jussieu, Las Cases, Orfila, Parisot, Villerme, Ajasson de Grandsagne, and other distinguished statesmen and philosophers in Paris !!!"

"THE NATURAL HISTORY OF ANIMALCULES."*

The valuable improvements which have been made in the microscope in modern times, combined with the powerful aids derived from the solar and oxy-hydrogen methods of illumination, have extended wonderfully our knowledge of animated nature. They have brought to light multitudes of inferior beings, of whose existence we had previously no conception—shown that below the lowest heretofore known there are myriads lower still. The rapid progress of discovery in this department of research, has made a new arrangement of the accumulated materials absolutely necessary. Müller's "Animalia Infusoria" was published in 1786, and could embrace, therefore, only the little that was then known. Dr. Ehrenberg's "Phytozoa" is of more recent date; but is confined to those animalcules who possess polygastric digestive organs—that is, something more than a simple alimentary canal, such as is seen in the eels in paste, stagnant sea-water, &c. A classification that should include every thing coming under the name of animalcules—every atom of matter in which the vital principle has been hitherto discovered was still wanted—and this is what Mr. Pritchard has attempted, and we think most satisfactorily accomplished in the "History" now before us. No one, probably, could have brought to the task greater familiarity with the subjects to be classified and described—a familiarity well attested by his share in the authorship of those excellent works, the "Microscopic Illustrations," and "Microscopic Cabinet" (see Mech. Mag. vol. xvii. page 444); and though not a very eloquent delineator, he is, what is still better, a methodical, correct, and discriminating one. The works of Müller and Ehrenberg form, confessedly, the groundwork of Mr. Pritchard's "History;" but he claims credit, at the same time, for having drawn his materials chiefly from his "own practical observations;" that is to say, he has adhered to the classifications of these authors, as far as they go, but depended on his own admirable achromatic microscope for the filling up. The plates, on the proper execution of which the value of works of this description so much depends, are, in every respect, worthy of the text. "Immense pains," says Mr. P. "have been taken to give the numerous drawings the appearance of what they are intended to represent when viewed under the microscope." The "pains" taken must indeed have been "immense;" nor do we think Mr. P. has in the least exaggerated the merits of his artist, Mr. Cleghorn, when he asserts that some of the plates, "in point of execution, can hardly be excelled."

Before entering upon the particular description of the different species of infusoria, Mr. Pritchard devotes a chapter to a general view of this branch of animated existence; and from this we shall, by way of preparation for the wonders that are to follow, extract a few passages.

"The term *animalcule*, which implies nothing more than the *diminutive* of animal, has been commonly used to denote those living creatures inhabiting fluids, which are too minute to be scanned, or even seen by the naked eye; such, for instance, as those produced in inconceivable numbers from infusions of animal and vegetable matter."

* * * * *

"It was a favourite hypothesis with naturalists, some years ago, that the class of animalcules under consideration was entirely nourished by cutaneous absorption, and that no suitable organs for transmitting and digesting food were discoverable. Baron Gleichen was the first who brought the truth of this theory to the test; for having tinged some water containing animalcules with carmine, he found, on the second day, that only some distinct cavities in the interior of their bodies were filled with the colouring matter, evidently demonstrating the existence of an alimentary structure; here, however, he left the subject, and it is to Dr. Ehrenberg's farther investigation of it that we are indebted

* The Natural History of Animalcules. Containing descriptions of all the known species of infusoria. With instructions for procuring and viewing them, &c. Illustrated by upwards of 300 magnified figures on steel. By Andrew Pritchard, Esq. Whittaker and Co. 1834.

for an accurate description of their different forms."

* * * * *

"By the application of coloured substances, which, moreover, have been found to invigorate rather than to depress the animalcule, and to maintain it in the full exercise of all its functions, an internal structure is discovered in some, equal, if not surpassing, that of many of the larger invertebrated animals, and comprising a muscular, nervous, and, in all probability, vascular system—all wonderfully contrived for their respective offices."

* * * * *

"Some animalcules resemble spheres, others are egg-shaped; others again represent fruit of various kinds, eels, serpents, and many of the invertebrated animals, funnels, tops, cylinders, pitchers, wheels, flasks, &c. &c.; all of which are found to possess their own particular habits, and to pursue a course of life best adapted to their particular constructions: thus, for instance, while some move through the water with the greatest imaginable rapidity, darting, leaping, or swimming, others merely creep or glide along, and many are altogether so passive, that it requires long and patient observation to discover any of their movements at all. One description are perceptibly soft, and yield easily to the touch; another are covered with a delicate shell or horn-like coat. Of the latter order there are different degrees of density, as in the voloox, gonuim, &c., where the envelope is comparatively thick, and where, strange to say, the internal substance separates by the mode of propagation into several portions, forming so many distinct young ones, which, at their birth, burst the envelope, and the parent becomes entirely dissipated. In others of this order, the shell is merely a plate covering the body, resembling that of the tortoise; sometimes it includes the body, so as to leave only two small apertures at the extremities, and at others it is broader, and encloses the creature, like that of the oyster or muscle."—pp. 11—24.

The most minute of these very minute beings form a genus, known by the very appropriate name of *monads;* and so excessively minute are they, that we are assured many millions of them may be taken up on the point of a pin! One might almost expect from this that Mr. Pritchard was disposed to go the length of the eminent botanist, Mr. Robert Brown, who, a few years ago, maintained (and perhaps still maintains) that "all bodies, organised or unorganised, consist of *animated molecules, having* a motion *peculiar to themselves;*" in other words, that every thing in nature is but an aggregate of living atoms, each having a separate and independent existence! But Mr. Pritchard does not go so far as that. Speaking of Mr. Brown, and his animated molecules, he says:—"Although I have examined them under a magnifying power of 3,000 times linear, *nothing like a vital principle, such as is exhibited by the monads, could be recognised*"—thus decidedly confirming the objections taken by Dr. Schultze and others to Mr. Brown's theory (see Mech. Mag., vol. xiv. page 140). The vitality of the monads, however, Mr. Pritchard (as will be seen from the following extract) considers to be not only past all question, but almost past improvement.

"This genus of animalcules includes the smallest forms in which a *voluntary* motion has been observed, even under the most powerful microscopes. This motion, until very recently, appeared to be the only property of life with which they are endowed, but the observations of Dr. Ehrenberg demonstrate an organisation *equally perfect* with animated beings of much larger dimensions. Their forms in general are simple, spherical or cylindrical masses, devoid of external members or processes; the mouth, which is with difficulty discerned, is a simple orifice, not furnished with ciliæ or hairs (except in one or two species); they are colourless and transparent as the clearest crystal, yet can no internal organisation be seen, excepting that connected with their *digestive function,* which consists of two or more globular cavities or sacs, probably communicating with each other by a tubular membrane, as in the larger polygastric animalcules, but which in this genus is too minute to be discerned; indeed, the stomachs or sacs themselves are only to be observed when the animalcule is fed with particles of colouring matter; the food on which they mainly exist being as pellucid as themselves; the cavities are invisible. They increase by a spontaneous division of the parent into two or more parts, and those parts or young again divide when they have attained their full size. As subjects of observation, they are principally interesting from their minuteness, being, as they are, the very limit of man's acquaintance with animated nature. Their diameters vary from 1-24,000th of an inch to 1-12,000th, consequently require a very high magnifying power to discern. They are numerous, and generally found congregating at the surface and around the decomposed matter of infusions, either vegetable or animal substances. Muhlenberg enumerates ten species, but Ehrenberg has included fifteen."

We have not the hardihood to contest altogether the vitality of these atoms, against such eminent authorities as Dr. Ehrenberg and Mr. Pritchard—our own experimental knowledge on the subject being but limited; but we may at least be permitted to question the validity of some of the conclusions which they have here drawn from the facts they observed. They say that the matter they saw was "*voluntary* motion." Now, admitting that they did observe a motion in these monads, quite distinct from the fluid in which they float—a motion not produced by any change of temperature in, or mechanical motion of, the fluid, which is the utmost, the evidence before us calls upon us to concede—it assuredly does not follow that there was any thing "*voluntary*" in such motion. To assume that, is to take a wide stride beyond what the facts warrant. How, again, is their organisation proved to be "*equally perfect* with animated beings of much larger dimensions"? It is confessed that "*no* internal organisation" can be seen, even with the most powerful microscopes, excepting "two or more globular cavities or sacs." But the globular cavities, we are told, are the "digestive organs" of the animalcule. And how is this proved? Because colouring matter finds its way into them. But may not the colouring matter find its way out of them as well, without undergoing the slightest alteration? The entrance of colouring matter into some portions of an atom, and not into others, only establishes the simple fact, that there are certain cavities in it; but what the use of these cavities may be, is necessarily all matter of conjecture.

The perusal of what follows may even suggest a doubt whether the existence of the cavities in question is as satisfactorily established as Dr. Ehrenberg and Mr. Pritchard imagine.

"*Monas termo*—the *End Monad.* This animalculæ, as its name implies, is a *mere point*, even when viewed under considerable magnifying powers; indeed, it is so very minute, that its existence cannot be discovered in the best instruments with a less amplification than 160,000 times (or 400 linear); and when higher powers are used (viz. 800 to 1200 times), it requires considerable address in the management of the *light in order to exhibit it.* The best illumination is obtained by condensed lamp-light, with proper stops to limit the quantity, for they are so delicate and transparent, that if much light be admitted they cannot be seen. In the aplanatic engiscope, with a power of 800 linear, Dr. Ehrenberg, by feeding them on very finely divided colouring matter, has been able to discern from two to six spots in them, which, by analogy with the larger infusoria, are stomachs, or digestive cavities. It may also be presumed that they possess, like the larger animalcules, but one orifice or mouth for the reception of food, and that they do not imbibe nourishment by cuticular absorption, as hitherto supposed; and it may be observed, that the coloured points occupy the hinder parts. In the drawing (fig. 1) is represented a group of these animalcules, magnified 800 diameters, or 640,000 times in surface: in some of them are shown the dots, as seen when they are fed on indigo; in their natural condition they are merely colourless globules. They differ in size from 1-24,000th to 1-9600th of an inch in diameter; the largest hitherto observed was found at Koliwan; in general, they do not exceed 1-18,000th in diameter. They are often so abundant on the surface of infusions that many millions in a single drop may be taken up on the head of a feeding pin. In the solar achromatic, in the confines of the light, *young* animalcules have been discerned much smaller than 1-24,000th of an inch, and it is probable that more perfect instruments would exhibit even smaller animated beings; to observe these, however, it is necessary to have finely divided opaque coloured matter in the fluid. It may be doubted whether any reasoning being, who has seen these minute living atoms, can contemplate them without the most positive conviction, that they are the work of an all-wise Creator, and, doubtless, intended by Him for some useful purpose in the economy of nature; for if we consider the almost countless numbers that exist in the small space of only an inch, whither will our imagination lead us, when we think on the myriads that would occupy the back of a single elephant!"

Dr. Ehrenberg was certain that he saw the "spots in them;" but, considering that one of these animalcules, "even when viewed under considerable magnifying powers," *is a mere point*, we presume to think that they might have been *upon*, instead of *in* them, without the doctor's being very well able to tell how the fact exactly stood.

But whether the colouring matter finds its way into the monad, or is deposited upon it, the part which it plays in these investigations furnishes

an illustration of the divisibility of matter which is in itself abundantly curious.

"If we take some of the largest of these animalcules, and suppose them to be arranged in a line of only one inch in length, it will require 9,600 to form it; so that a cubic inch would contain 884,736 millions; an ocular demonstration, it would seem, of the divisibility of animal matter. And if we investigate the thickness of their skins, or the tissue which encloses the coloured particles, it will be found to be less than any substance we are acquainted with in inorganic matter; and will afford, at the same time, a better idea of the minuteness of the particles of vegetable colouring matter than any other method we can devise. Thus, for instance, presuming there are only four particles of colouring matter in each cavity or stomach, and four sacs or cavities in each animalcule, the said cubic inch of animalcules will contain the immense number of 14,155,776 millions of particles; and if the solid matter of the animalcules be supposed to occupy only one-half of the space, a solid inch of indigo will contain twice that number of particles."—p. 29.

As we ascend the scale of animalcular being—from the genus "Monad" to the genus "Vorticella" (" visible to the naked eye")—the evidence of organisation becomes gradually more distinct and clear, and is at last too strong to admit of any reasonable doubt.

We cannot afford the space requisite to exemplify this by individual instances, but we shall quote a page or two of a general nature, to show the bearings of the evidence, and therewith conclude.

"A muscular system being the proper agent of voluntary contraction in the animal kingdom, its existence might fairly be expected in the infusoria; creatures so remarkable for the rapidity and energy with which they propel and translate themselves from one situation to another. In respect to the former, they can only be compared with fishes; in the latter with insects. The mere contractibility of tissue can never surely afford a sufficient explanation of those active voluntary efforts, *by which they avoid every obstacle, where myriads of creatures are swimming in a single drop of water*, by which also they convey nutriment towards their mouths, and perform the acts of deglutition. * * * The superior size and diaphonous nature of the vorticella, enable us, under the microscope, to discern several distinct bands of fibres, of a greyish white colour; that these *fibres perform the office* of muscles *is evident, by their contraction* and dilatation; in contracting they become shorter, broader, and more opaque, on the contracted side of the animalcule, and on the opposite side the antagonist fibres elongate and almost vanish, in consequence of their increased transparency. These facts * * place beyond a doubt their muscular nature, and that they are the real agents in effecting t motions of the animalcule. * * * * That these filaments and ganglia (alluding to certain appearances distinct from those last noticed) are not muscles, is evident from their form, their mode of insertion, and their not being shortened in the contraction of the animal, but assuming a serpentine form, being apparently passive. That they are not vessels is also evident, because no pulsation or circulating fluid has ever been perceived in them: hence, by fair reasoning, we may safely conclude that they form a nervous system; and it is well remarked by Mr. Johnston (*Edin. Phil. Journal*), that, according to all our ideas of known physiological laws, the existence of active voluntary motion presupposes the necessity of an animating nervous system."—pp. 165, 166.

HEATONS' STEAM-CARRIAGE.

Sir,—The advocates for steam travelling on common turnpike-roads, have, for some time past, been anxiously awaiting the *debut* of Messrs. Heaton, Brothers', new locomotive, which has at length taken place. The sanguine expectations which Messrs. Heatons' previous eminently successful experiments gave rise to, have, however, been disappointed, by the results of more recent trials with the new and more powerful engine. In this engine the weight, wear and tear, and consumption of steam, have proved so much greater than was calculated upon, that Messrs. Heatons' have been compelled to entertain views on the subject differing widely from those with which they started.

In the course of a few experimental trips with their new engine, which is a very beautiful machine, Messrs. Heatons have been compelled to doubt the possibility of steam locomotion on common roads, at *an average speed of ten miles an hour*, the wear and tear of machinery, with other incidental expenses, being so great as to exceed any probable receipts; profitable running, therefore, at this speed—and it is presumed a slower would not be tolerated—they believe to be impracticable.

The following paragraph appeared in the *Birmingham Journal* of the 12th instant:—

"We are authorised, by the committee of Heatons' Steam-carriage Company, to state, that the result of the experiments hitherto made with their engine has not proved satisfactory, and that they will shortly call a meeting of the shareholders, to take into consideration a communication made to the committee by Messrs. Heatons on the subject."

After expending upwards of two thousand pounds in endeavouring to effect steam travelling, Messrs. Heatons now retire from the field; their candid and upright conduct throughout this business is highly honourable to them, and forms a striking contrast to the delusions practised elsewhere.

I am, sir, yours respectfully,
W. BADDELEY.

10, Wilderness-row, Goswell street,
April 28, 1834.

NOTES AND NOTICES.

The country is much indebted to Mr. Smith, of Southam, for his exertions to promote the establishment of dispensaries, for the purpose of enabling the labouring classes to defray, from their own resources, the expense of medical treatment. It appears to us that great good has already been effected by these dispensaries, and that much more may be effected by them; but we are not prepared to suggest any legislative measures for their encouragement.—*The Report of the Poor Law Commissioners.* We have repeatedly recommended these admirable institutions to the attention of our readers, and are glad to learn that they are on the increase. One has been recently established in St. Pancras, which offers to the industrious artisan surgical and medical attendance for the small sum of sixpence per month, and the choice of any one of nine regular practitioners of the highest respectability.

Steam Carriages.—On Tuesday last, a single carriage, belonging to the Steam Carriage Company of Scotland, performed the most successful runs that have ever been accomplished on the common roads, having gone six successive trips with passengers between Glasgow and Paisley, and in an average time of 41 minutes; the first trip having been done in 40 minutes, the second in 43, and so on, being a distance, in all, of 46 miles in 4½ hours, at a rate of more than 10 miles an hour. On the previous day, the same carriage had run the distance four times at a similar rate, and on Wednesday it was again done within 40 minutes. The other carriages continue running daily, and the communication between Glasgow and Paisley, by means of these carriages, may now be considered as fully and permanently established—*Glasgow Argus.*

The *Athenæum* states that the Observatory at Mackrea Castle, Coloony, in the county of Sligo, belonging to Edward Joshua Cooper, Esq., the member for that county, has been enriched with an equatorial refracting telescope, of the extraordinary length of 23 feet 6 inches, the diameter of its object-glass being 13 inches and 3-10ths. The weight of the tube and its mounting is 3 tons; yet so perfectly steady is this stupendous instrument, that Mr. Cooper has been already enabled to make very satisfactory micrometrical measurements of the most difficult double stars. The polar axis, which is upwards of 7 feet long, is supported on a pyramidal mass of masonry. The total cost, exclusive of the object-glass, has been less than 500*l.*, and the whole has been completed within the short space of eleven months, by two ingenious Dublin artists, of the names of Sharp and Grubb. The object-glass is by Guinand, and figured by Cauchoix.

We are sorry to learn, from the same authority, that Sir James South has not yet been able to make use of the large equatorial telescope which he lately erected at his Observatory on Campden-hill, Kensington, owing to its unsteadiness.

The failure of chloride of lime to remove "certain noxious smells," of which "Rusticus" complains, has no doubt arisen from some impropriety in the method of employing it. He has probably placed it in an open saucer, on or near the floor of the apartment he wished to purify—a very common practice—and because it gave forth its peculiar odour in abundance, he may have imagined that its disinfecting virtue was in full operation. If so, it is no wonder he should have been disappointed. The disinfecting virtue does not reside in the peculiar odour, but in the chlorine gas contained in the chloride; nor does it follow, that where there is an abundance of the former, there must be any appreciable disengagement of the latter. Chlorine is so much heavier than the common atmospheric air, that it diffuses itself through it with difficulty—so much so, that it has been calculated that chloride of lime does not emit, *spontaneously*, one thousandth part of the gas embodied in it. It may be readily disengaged, however, by pouring a few drops of muriatic acid upon the chloride in the saucer; and if our correspondent will try this, we think he will find that its purifying properties have by no means been overrated.

The durability of Mr. Chubb's Detector Locks was lately put to a remarkably severe test in the dock-yard at Portsmouth. One of them having been attached to a steam-engine, so as to be alternately locked and unlocked by the action of the piston, it went through this process no less than 460,000 times, and when examined, was found not in the least injured by the extraordinary friction to which it had been subjected.

The Smalls light-house, in St. George's Channel, is erected on iron pillars, 40 feet high, which are bedded in a half sunken rock, but so great is the danger of the situation that, in case of accidents, the lantern itself is said to be placed in a boat! The revenue derived from it is divided between two female individuals (one of them a lady), and amounts, after payment of all expenses, to between 8,000*l*, and 9,000*l*. per annum. It is *surely* high time that this, and all light-houses similarly circumstanced, should be brought under the control of Government.

The ascent of Holborn-hill might, in the opinion of an intelligent correspondent (C.), be rendered much less difficult and dangerous, if it were paved partly with granite and partly with wooden blocks, after the manner lately described in this Journal as practised in St. Petersburgh. We think so, too; and hope the suggestion may meet with attention from those who have the power to carry it into effect.

The total number of light-houses in Great Britain and Ireland is 178. In England there are 98, of which 34 are under the direction of the Trinity-house, 54 belong to corporate bodies, and 10 are held by female individuals. In Scotland there are 42, of which 26 are managed by the Northern Light Commissioners, and 5 are in female hands. Ireland has 38, all under the management of the Ballast Board of Dublin.

Boiler Plates vary from a quarter to three-quarters of an inch in thickness. J. P. will be safe with the quarter of an inch size, if the metal is of the best quality. The thickness has nothing to do with the size of the boiler, but is the same for all sizes under the same pressure.

Dr. Church's Steam-Carriage was started for the first time, on Friday evening, from the manufactory. It proceeded at a very rapid rate (say from 15 to 20 miles an hour), with about forty passengers upon it, for a considerable distance, when, in turning short about upon the road, the hind part struck the footpath, and broke a small appendage to one of the valves. It was then deemed advisable not to work the machinery further, for fear of accident, but to attach the ropes and haul it back by the workmen.—*Birmingham Gazette.*

Communications received from Mr. J. R. White—Mr. Holmes—G. D.—Mr. Saunders—Clio—Mr. Blackett.

The Supplement to our last Volume, containing Title, Table of Contents, Index, &c., with a Portrait, on Steel, of William Symington, the Inventor of Steam Navigation, is now ready, price 6*d.*; also Vol. XX., complete, in boards, price 8*s.*

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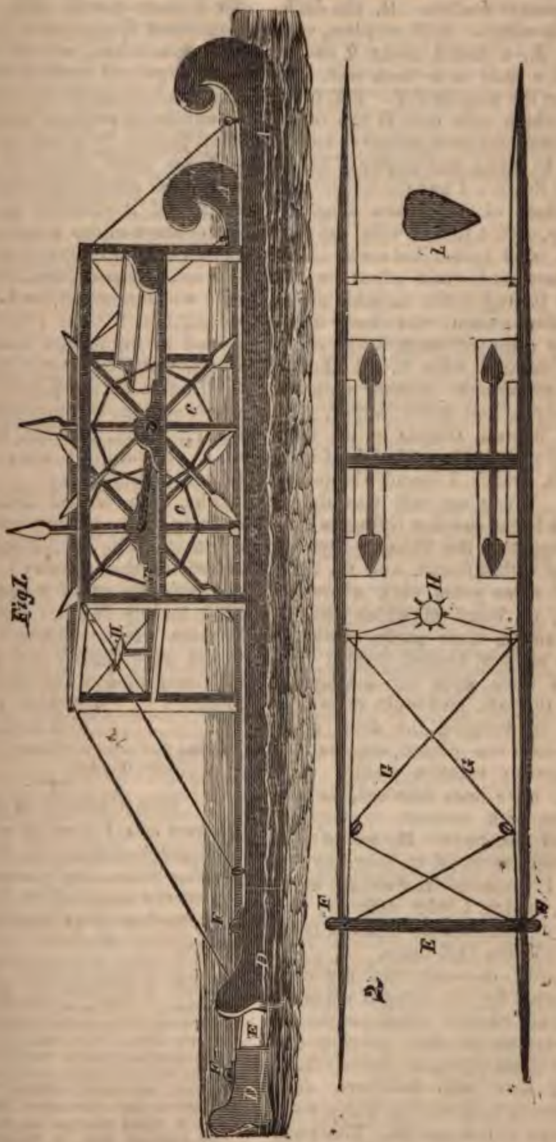
CANNING'S DISPATCH-RAFT.



CANNING'S DISPATCH-RAFT.

Sir,—I enclose a rough sketch of one of the model sailing or steam-rafts, alluded to in the letter which you did me the favour to insert in your Journal of the 22d March last.

A A, represent floaters. B, the deck. C C, paddle-wheels. D D, rudders, connected by E, a board about 7 inches wide, with a hole near each end, into which insert the nipples F F. F F, G G, till-ropes, which pass over H the tiller-wheel. I, cross-section of floater or trunk.

In order to give a due degree of buoyancy to the floaters, I had them hollowed into chambers of 14 inches long, 10 inches deep, and 4 inches wide, leaving solid parts of 3 inches between. This raft was destroyed while afloat on the Seine-river (owing to the culpable negligence of the person who had it in charge), by a loaded barge which came in violent contact with it. I shortly afterwards constructed another upon the same principle, but much larger, and instead of floaters, similar to the first, made use of troughs formed of half-inch deal boards, which I found also to answer well. When my raft was almost finished, as I was one day trying its rate of going opposite the Champs Elysées, in company with a friend, and my little son (about three years old), a French steam-boat, on board of which was the proprietor and a large party, evidently quitted its original course, dashed with tremendous force upon the starboard-quarter of the raft, and broke it up in a twinkling, submerging the deck upon which the child was placed, who but for instant vigorous exertion would, with my friend, have been drowned, as the current runs with extreme rapidity in that part of the river. My friend and the youth were received on board by the steamer. I preferred remaining upon the wreck, which I with difficulty got ashore, at a considerable distance from where the collision took place.

I soon after re-constructed my raft, and substituted for the troughs a double row of small barrels, twenty-eight in number, varying in size, placing the largest the fourth from the bows; these I boarded over with half-inch deal boards, forming long staves, which were screwed down to the barrels. The ends of the boards projected beyond the barrels at both ends of the trunks, so as to form stems and sterns. The interstices between the heads of the barrels, and the outside planks, were filled up with a mixture of pitch, tar, cork-shavings, saw-dust, and rosin.

This raft was greatly admired. I had the honour of receiving our veteran hero, Sir Sydney Smith, with a host of distinguished English and French, on board at various times, who all seemed to approve highly of the principle upon which it was constructed—considering that it would insure personal safety in an eminent degree, as it was neither liable to sink nor upset, while its rate of going was much greater than any other sailing craft, and it afforded an incomparably more commodious place for passengers than a boat of ordinary build.

I next contemplated the construction of a still larger raft, to be propelled by steam, but, for the reasons already assigned in my former communication, I was not able to procure permission from the Prefect of the Seine. I soon afterwards sold my raft to Colonel, now General Trobriand, and Mr. Mallett, to run as a pleasure-raft upon the celebrated lake of Montmorency.

The 20th of last December (consequently prior to any account of the raft constructed by Mr. Burden being received in this country,) I commenced the construction of a small raft of the kind for my own use, to run upon the Thames. It is almost finished, and would have been some time back, but for circumstances not connected with the affair. I remain, sir,

ALFRED CANNING.

Crown Coffee-house, Holborn,
April 17, 1834.

STEAM-BOILER EXPLOSIONS.

Abstract of a Report by a Board of Examiners appointed by the Connecticut River Steam-boat Company, to inquire into the causes of the Explosion of the Steam-boat New England.

[The explosion which forms the subject of this Report, for which we are indebted to the Franklin Journal, occurred at Essex on the Hudson, on the 9th of Oct. 1833; six persons were blown overboard, of whom two were drowned, and nine others were so severely wounded that they died shortly after. The Board of Examiners first proceeded to examine the boat and the remains of the boilers; then to take the testimony of the captain, engineers, firemen, and others, who witnessed the catastrophe; and finally to report on the whole matter. As the substance of the oral evidence may be gathered from the summary of the examiners, we shall pass it over altogether in the following abstract, and confine ourselves to the more material parts of the Report.—ED. M. M.]

On visiting the steam-boat, we found that those portions of the guards and railings, on which the boilers had been placed, together with the boiler houses, railings, and the other contiguous wood work, had been entirely destroyed by the effects of the explosion. The front of the ladies' cabin upon the quarter deck had also been forced inward, and partially destroyed, and that part of the upper, or promenade deck, which extended from said cabin to the engine-room near the centre of the boat, had been swept entirely away. The engine remained without injury; but the steam pipe which led from one of the boilers was broken off at its junction with the main steam pipe in the engine-room, near the point where it unites with the steam pipe from the starboard boiler. The *safety valve*, which is attached to the main steam pipe at the junction of the two branch pipes near the engine, remains unimpaired, and is a large and apparently well constructed valve. A mercurial *steam gauge* is attached to the main steam pipe at this point. The mercury was not thrown from this gauge by the explosion, and the gauge remained in good order after the accident. Two other mercurial gauges of the same description were shown to us, which had been attached one to each of the boilers, on that part called the steam chimney, which having no water in contact with its inner surface, becomes heated more than any other portion of the boiler. These gauges had been torn from their places at the time of the explosion, and in one of them a portion of the mercury with which it had been charged was found remaining after the accident. It was ascertained, on admeasurement, that these steam gauges were calculated to resist a pressure of about 32 pounds to the inch without discharging the mercury.

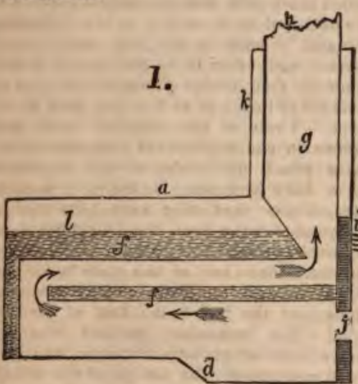
The mutilated portions of the *boilers* which were examined, gave abundant evidence of the great power or force of the explosive action. The material was rolled copper of the usual thickness. The original form of each boiler (see the accompanying figures) was semi-circular, with extended sides, the latter descending perpendicularly; and uniting at bottom with similar extensions of two inferior arches, which severally formed the roofs of the two furnaces or main flues, that extended longitudinally through each boiler. The interior extension of these arches also descended, in two parallel sides, to the bottom of the boiler, forming, like the two sides of the boiler, what is technically called a *water-leg*. These parallel or flat sides, as well as the middle leg, were connected at distances of nine inches by copper bolts of seven-eighths of an inch in diameter, which passed through the sides, and fastened the internal to the external plates or surface of the water-legs, the spaces remaining between which, for the reception of the water, was from three to four inches. The arches or roofs of the furnace flues were also connected by long brace-bolts, and other fastenings, to the upper parts of the boiler, as a further security against the downward pressure to which the arches are subject. Above these arches, in the interior of the boiler, were placed five round *flues*, surrounded by the water, and extending longitudinally through the boiler on a horizontal level. The fire, after passing under the arches through nearly the whole length of the boiler, returned through these flues to the front of the boiler, where the flues united by one common connexion with the chimney. The lower part of the chimney, for a few feet in extent, is formed by a vertical extension, in the cylindrical form, of both the inner and outer shell of the boiler. These internal and external cylinders are secured to each other by brace-bolts, as before described. In this portion of the boiler the steam is heated and rarified by the passage of the fire or heat through the inner cylinder or flue as it ascends the chimney. This part of the boiler is called the *steam chimney*, and here were attached the pipes which conduct the steam to the engine. These portions of the boilers have received no injury from the explosion, but were severally found attached to the flues of one boiler, and to the remains of the outer shell of the other. The cylindrical flues, which must have been the soonest exposed to the action of heat, in case of the deficiency of water, remain in the most perfect order, those of each boiler being still united to each other by their terminal connexions, and no evidence of exposure to heat has been discovered. Those of the larboard boiler were thrown on end against the enclosure of the water wheel, and those of the starboard boiler have been since found in a position which shows that they have been thrown sternwise over the boat, and had fallen into the river at some distance from her larboard quarter. The shell of the same boiler was separated from the flues, and thrown outwards into the river; and that of the larboard boiler was also separated from the flues and thrown towards the shore, and was found resting upon the margin of the wharf, the boat being perhaps thirty yards distant from the wharf at the time of the explosion. Both the external shell and internal arches of the boilers have entirely lost their original form, and, to a considerable extent, this form is inverted or turned inside out. The whole was found to be dismembered and torn in a manner which it is difficult to describe. The boilers were not, as occurs in some cases of steam-boat explosions, rent merely in the main flue, thus giving vent to the steam;

or, as in other cases, with a head torn off and lacerated, and still retaining their external form and remaining in their beds; but the boilers of the New England were torn asunder, and folded in massy doublings, like a garment; and they were so crushed, flattened, and distorted, that, as they lay upon the wharf after they were raised from the bed of the river, it was difficult for a common observer to discover how the mutilated parts were ever connected into symmetry, so as to combine just proportion and strength.

The appearance of the boilers, however, was such as to indicate that they had been constructed in a substantial manner. The copper, in all the ruptured parts, had every appearance of being tough and free from flaws; nor did it exhibit the flaking and discolouration which great heat is known to produce upon the metal when not covered by water. The metal varied in thickness in the different parts, the legs being made of No. 3, the shell of No 4, and the return flues of No. 5; the strength being in each case adapted to the situation or degree of exposure; and much additional strength was further secured to all parts of the boilers by a frequent and liberal use of bolts and braces.

We annex sketches of the longitudinal and cross sections of the boilers of the New England, reduced from the original drafts from which the boilers were constructed, which will serve to illustrate the foregoing descriptions.

1.



2.

a The outer shell of the boiler; *b b* the arches or tops of the main or furnace flues; *c c* the steam chimney; *d d d* the water legs; *e e e e* the upper or return flues; *f f f* the water in the boilers; *g g g g g* the passage for the fire through the flues to the chimney; *h* the iron chimney pipe cut off above its junction with the steam chimney; *j* the furnace door; *i* the water cocks.

* * * * *

The various theories and conjectures which have been put forward to account for this disaster, may be comprised under the three following heads:—

1. The production of some *gas* (probably hydrogen), suddenly evolved in great quantity.

2. A supposed injurious *heating of the water legs* (*d d d*, fig. 2) and lower parts of the boiler, in consequence of the water being driven by the steam into the upper part of the boiler, and perhaps causing a rapid production of steam on its return to the heated metal.

3. A *deficiency* at the time of the accident *in the quantity of water* which it is necessary to carry in the boilers, owing to the carelessness of those in attendance, or to their being deceived in the examinations of the water cocks. It has been supposed that the metal of the boilers may thus have been weakened by heat, or that the sudden suffusion of water on the metal thus heated, occasioned by the sudden discharge of steam at the safety valve, may have generated steam in such quantity, and in a manner so instantaneous, as to dest oy the boiler.

4. *Stress of steam* accumulated beyond what the boilers were able to sustain.

1. *It is supposed by some that the explosion was produced by gas.*

On this supposition we may remark, that upon our arrival at the scene of the disaster, we found this to be a favourite hypothesis with a number of sensible and reflecting men, who were so strongly impressed with the energy of the force requisite to produce so powerful an explosion, that they were disposed to look for some extraordinary cause. We cannot, however, see grounds for adopting this view. Even in the case of iron boilers, heated red hot, we believe that the production of hydrogen gas in any such quantity as to cause the explosion of a boiler, has never yet been proved, although it is undoubtedly true that iron thus heated has the power of decomposing water and evolving hydrogen gas; and the gas, when thus liberated, would, indeed, act as a force auxiliary to the steam; but the decomposition, and consequent production of hydrogen, would have its limits from the oxidation and the cooling of the iron. Steam has never been decomposed by heat alone. Water yields

up its elements, oxygen and hydrogen, to electricity, especially to galvanic electricity, but not to simple temperature, however high. Heat requires to be aided by the attraction of some substances which will remove the oxygen, and thus liberate the hydrogen. Copper cannot do this, even at a white heat. Copper thus heated would produce a great abundance of steam, but no inflammable gas.*

In the boilers of the New England, there was no iron; all the pins, bolts, and rivets, were of copper. There were, indeed, a few square feet of iron plate in the chimneys, to which the steam had access on one side, and there can be no doubt that these flues frequently became red hot. The surface exposed to the steam is, however, soon oxidised by the vapour, especially that from saline fluids, and must then become incapable of decomposing water.

Granting, however, that in the case before us, this decomposition did take place to a certain extent, the hydrogen gas, being the lightest body known, would not descend into the boiler, but would pass on into the steam tube, and into the cylinder. Here, indeed, it might, to a degree, repress the strokes of the piston, being itself uncondensible; but it would ultimately pass into the condenser, and be thrown out into the atmosphere through the air pump. Its production, if it ever happen, would be confined to a few days when the chimney was new, and the quantity would be too small to be of any importance. Since hydrogen gas, when mixed with a certain quantity of air, and ignited, has the property of exploding with violence, it has been suggested, that its agency in steam-boat explosions is due to this property, and not to its acting simply as an auxiliary to the pressure of the steam. A volume of common air equal to several volumes of the hydrogen present, would be required to render the mixture explosive; but we know of no source whence such a quantity of common air could be supplied. We therefore conclude that, in the actual circumstances, neither hydrogen gas (nor, as we believe, any other gas), can ever aid in the explosion of a steam-boat boiler, except simply by adding just so much elastic power as the same volume of steam, at the same high temperature would produce, and no more.

2. *Others ascribe the explosion in question to an overheating of the water legs of the boiler.* We have no proof that metal can be thus heated while under the superincumbent pressure of a body of water, with a fire of pine wood, as used in these boilers. It ought also to be objected that the water legs are, for the most part, near to the bottom of the flues, and are therefore less exposed to the action of the fire than the arches and higher parts of the boiler. No difficulty of this kind is known to occur in other boilers of like construction. In the boilers of locomotive engines, a strongly heated blast is driven through copper flues placed in contact with a much smaller volume of water, under circumstances which are vastly more suited to produce the supposed effect, and yet these boilers are used with safety. We cannot, therefore, ascribe the explosion to this cause.

3. *By others the explosion is ascribed to deficiency of water.* To this cause all disasters of this kind are usually ascribed, and there is, perhaps, a prevailing disposition among practical men to account for them in this manner. That there is always some hazard from this source attending the use of steam-boilers, especially those of ordinary strength, is undoubtedly true; and in the absence of all evidence in the case, it might be proper to resort to this as the most probable conjecture. But it would be folly to adopt this opinion when contrary to all the evidence, and especially so in a case where adequate cause could be shown without resorting to this hypothesis. To insist, in all such cases, as has too often been done, that this is the true and only cause of these disasters is, as we fear, but too likely to perpetuate their occurrence; for so long as this opinion is cherished, the security afforded by an increased strength of the boilers is likely to be neglected. The tremendous exertion of force in the case under consideration, has been urged as evidence that the explosion was of this character, but, as we think, without sufficient reason. The aggregate expansive force upon the whole internal surface of each boiler could not have been less than 3,000,000 pounds, which must be acknowledged to be adequate to the effect produced. Besides this, we have noticed that the great external arch and outer shell of either boiler was not torn asunder, except as it was separated from the ends and the inner shell; and this part of each boiler now constitutes one ex-

* Copper will pass, in a melted state, and at a white heat, through a high column of water, and remain for some time ignited at the bottom of the vessel, Heated copper generates steam with great rapidity. According to the statement of Mr. Adam Hall, ten pounds of copper heated to such a degree of redness as to be merely visible in the dark, will convert a pound of water into steam, making more than twenty-seven cubic feet at the common atmospheric pressure. It follows, therefore, that copper flues having, on the whole, an extensive surface, and great weight, may produce an uncontrollable quantity of steam, even at a heat far below redness. This fact suggests an additional reason, if any were necessary, why the water should be most anxiously guarded from falling below the top of the flues.—(See the valuable experiments of Professor Johnston *on the comparative quantities of steam produced by heated metals*, in the American Journal of Science.)

tensive but unsightly sheet of copper. The upper flues, too, with their connecting parts, as also the steam chimney, have received no injury; which facts appear unaccountable, if the case was of that highly explosive kind which has been supposed. The explosion of both the boilers, at almost the same instant of time, has also been urged in support of this hypothesis, but we do not see that any confirmation can be derived from this fact; for it is known that the two boilers were supplied from different pumps, were intrusted to the care of different hands, and were in these respects entirely independent of each other. It is therefore not probable, to say the least, that both the boilers should become fatally deficient in their supply of water, at exactly the same time. And furthermore, it does not appear that any sudden relief was given to the boilers, either by raising the safety-valve, or starting the engine, which, in case of such scarcity of water, could have caused it to rise suddenly upon the heated metal in the manner supposed. In view of all the circumstances of the case, and of the ample evidence afforded by the present state of the metal and the testimony of the witnesses, showing that the boilers were well supplied with water at this time, we reject this supposition as altogether indefensible.

4. We are therefore constrained to adopt the remaining conclusion, and give it as the unanimous opinion of the Board of Examiners.

That the explosion of the steam-boat New England was caused by the pressure of steam, produced in the ordinary way, but accumulated to a degree of tension which the boilers were unable to sustain.

It appears that the boat started from Lyme, very strongly, under the head of steam which had accumulated while landing at that place: that immediately after, the pilot found it necessary to order the steam to be shut off from the engine in order to facilitate the steering of the boat, that the steam continued shut off (throttle valve closed, or nearly so,) during the greater part of the passage from Lyme to Essex, a distance of three or four miles; that when the boat arrived at Essex, there was, by the fireman's gauges, a pressure of about twenty-six inches; (equal to a column of fifty-two inches of mercury, or near twenty-six pounds to the square inch;) that the safety-valve was not raised to blow off the steam while the boat stopped at Essex; that previous to the explosion, the float-rod of one of the gauges had risen to the boiler deck, a height of twenty-eight inches, according to Mr. Potter's admeasurement, and that this pressure was rapidly increasing, while on no former occasion had it been known to exceed twenty-four inches.* As the mercury remained in two of the steam-gauges, the greatest pressure must have been less than thirty-two inches, and we conclude that the steam was allowed to accumulate nearly, or quite, to thirty inches; and that at this juncture the weakest part of one, or both, the boilers gave way, tearing the adjacent parts asunder, breaking in rapid succession the nearest brace-bolts, and involving all else in one sudden and common ruin. The noise of the steam previously heard on shore by Mr. Hayden, appears to us to have been the natural discharge of surplus steam by the safety-valve, beyond what the weights would confine, as in the case of twenty-four inches pressure, mentioned by Mr. Potter. This partial blowing off, which indicated great pressure, does not appear to have been particularly noticed by the engineers, or other persons engaged in active duty at the time. It is true that the amount of pressure proved by the two firemen was not so observed by the engineers; but Younger tells us that he did not see the engineer's gauge while at Essex, and furthermore that he could not see it while standing at his post; and it is conceived that Marshall, in the obscurity of night, and while assiduously engaged in his other duties, might easily mistake, or overlook, the movements of so small an instrument as the gauge-rod.

An almost simultaneous explosion of two boilers, may probably be accounted for by considering that they were as nearly as possible of the same strength, and were necessarily subject to the same pressure; or we may reasonably suppose an instantaneous impulse or concussion to have been communicated from the first boiler to the second, while the latter was strained to the extreme limit of its strength.

Our conclusion may perhaps be met by Mr. Hall's opinion, that the boilers would have sustained a pressure of fifty pounds to the inch, provided that every part was sound, and bore its proper share of the strain. But, with all due deference to this opinion, we must still think his estimate a great deal too high; and it does not appear that a copper boiler of this description has ever been proved to such an extent. We learn from the experiments of Guyton Morveau, that the tenacity of iron as compared with copper, is nearly 549 to 302, showing a difference of more than 80 per cent. in favour of iron. Now, if we make our estimate from the pressure at which these boilers are supposed to have given way, they would, if constructed of iron of the same thickness, have sustained a

* By the gauge in the engine-room.

pressure of about fifty-four pounds to the square inch; which, in our view, is more than twice the pressure that a prudent engineer would have carried upon them. It is believed, also, that the actual strength of these boilers, as compared with those which are usually constructed for steam of high-pressure, will fully justify these conclusions.

Reports have been in circulation, that the explosion of the New England was occasioned by *racing*; but, after careful investigation, we see no reason to connect this accident with any supposed competition with other steam-boats.

As regards the bearing of our conclusion, we do not feel it necessary to attach any high degree of blame to those who were in the charge of the boat and engine at the time of the accident; and they may justly be exonerated from any charge of voluntary or wilful misconduct. Their leading error, or fault, seems to have been, too much confidence entertained by them in the security of the boilers, strengthened perhaps by too little acquaintance with the management of engines of this powerful kind; by which means they may have been led to disregard, or overlook, the rapid production of steam which is necessary to such engines. It seems necessary, in managing boats of this description, to close the damper of the chimney, and to open the safety valve, immediately when a stop is made, and to continue these precautions so long as the detention shall exist.

The Board of Examiners are fully and unanimously of the opinion that in the construction and management of this boat, the steam-boat company used their best endeavours for the accommodation of the public, and committed the navigation of it to persons of established reputation for prudence and skill in their profession.

The proprietors of the New England appear to have spared no expense in procuring a safe and efficient steam-boat for the conveyance of passengers; and the disappointment and deep regret resulting from this sad catastrophe, is doubtless more largely shared by them than by the great mass of their fellow citizens. Perhaps one of the remote causes of the disaster may be found in their desire to satisfy the wishes and expectations of the public, in furnishing copper boilers for the New England as well as for the Oliver Ellsworth, after the failure of an iron boiler, which was formerly used in the last named boat. It may be presumed that copper boilers will be less likely to be preferred hereafter, especially for steam-boats, in which the late improvement of working the steam expansively has been adopted.

The great practical object aimed at in this inquiry is to promote, by any practicable means, the future safety of passengers travelling in steam-boats. It is not sufficient that the number of these accidents, as compared with the increased number of steam-boats, is gradually lessening, or that this mode of travelling is even now safer, on an average, than any which is afforded by the ordinary method of conveyance. Much yet remains to be done by way of affording additional security.

The great advantages which result from working steam expansively, are such as to preclude the idea that it will ever be abandoned, and it is beginning to be adopted in the British steam-boats. But we think that the owners of our steam-boats are imperatively called upon to adopt a stronger form of boiler for engines of this description. Experience has shown that when the form of the boiler is perfectly cylindrical in all its principal parts, and of small diameter, that even a rent in the boiler, or an absolute deficiency of water, is but seldom attended with calamitous results; while the great range of strength beyond the ordinary pressure of steam which such boilers possess, precludes the accumulation of pressure to a dangerous point by any of the ordinary detentions or casualties. It is now known that circular flues can be constructed of a very small size with increasing safety and advantage, and we confidently expect that a combination of parts can be made upon the principles here recommended, which shall furnish steam sufficient for the supply of the largest engines; while the degree of safety shall be so much increased, as will reduce the hazard of travelling in steam-boats to an almost inappreciable ratio; and while our rivers shall be navigated by these wonderful vessels, one of the highest gifts of art and civilisation, and our plains be traversed by the unrivalled speed of the locomotive, it is hoped that we never may have occasion to lament such a melancholy disaster as that which has occasioned our present labours.

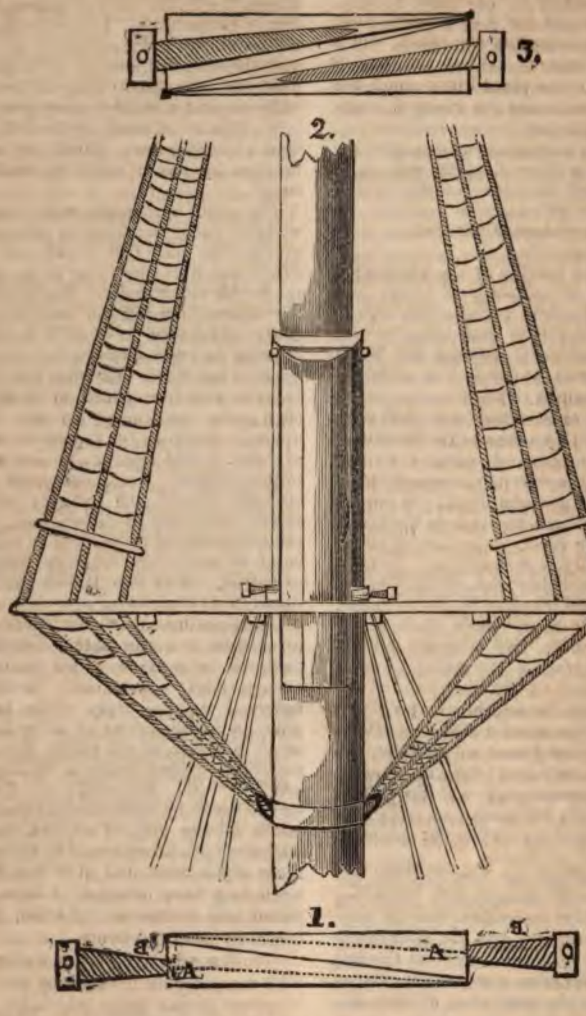
B. Silliman, Professor of Chemistry, &c., Yale College.

W. C. Redfield, Engineer, and Agent to the Steam Navigation Company of New York.

Denison Olmstead, Professor of Natural Philosophy, &c., Yale College.

Daniel Copeland, Engineer, and Manufacturer of Steam Engines, Hartford.

John F. Lawson, Engineer of the Steam-boat Chief Justice Marshall.



SCREW WEDGE FID.

Sir,—I take the liberty of forwarding to you a drawing of the screw wedge fid, having observed how willing you are at all times to make known, through the medium of your valuable Magazine, any new invention in connexion with naval improvement.

This fid possesses the advantage of *raising or lowering the mast*, so as to prevent straining or warping by the contraction of the cordage, as also to obviate the necessity of lowering the mast without first slacking the rigging—an operation which, with the common wooden or iron fids, occupies much time, attended with consequent exposure to accidents. A model of the invention may be seen at the National Gallery of Practical Sci-

ence, West Strand, and also at Mr. John Frazer's, engineer, 103, Houndsditch.

This fid can be fitted to a mast without striking or lowering the same, and is not liable to injury. When the mast is unfidded it may be placed in a small box in the top, and is always ready for use.

I remain, sir,

Your obedient servant,

EDW. WHITLEY BAKER.

Old Broad-street, City.

Description of the Fid.

Fig. 1, the fid without any strain upon it. A A are two wedges divided down the centre, in which are mortices for the two taper screws B B to work in. It is obvious that by turning the screws the wedges will expand and raise the mast to the height required.

Fig. 2, a mast fitted with the screw wedge fid. The screws are hove in a turn or two, so as to raise the mast. When the mast is to be struck, heave taught the mast-rope, heave back the screws a turn or two, the fid may then be withdrawn and the mast lowered. It may be refidded in a few minutes, when required. Vessels fitted with this fid must have their fid-holes of a greater depth than when fitted with the common fid.

Fig.3 shows the fid in its expanded state

P. S.—There is another screw fid, invented and patented by Messrs. Pearce and Gardner, of Liverpool, which, from the manner in which the screws are placed, would, I think, be liable to injure the worms, and thereby render it impossible to ship the mast, owing to the friction caused by the pitching of the vessel in a cross sea, or the backing or filling of the sails in light variable winds.

THE LATE WILLIAM SYMINGTON AND THE INVENTION OF STEAM NAVIGATION.

Sir,—The relatives of the late Mr. Symington consider themselves as under weighty obligations for the kind, generous and manly way in which you have advocated his claims; and sincerely trust that the sense of justice and the love of truth manifested in your proceedings in this instance, will not only raise you individually in the estimation of the discerning portion of the public, but also enhance the value of your impartial, valuable, and widely circulated journal.

In reference to the article contained in your last number, on the subject of Mr. Symington's claims and Mr. Taylor's pretensions, I beg leave to direct your attention to the following statements, as they are not altogether correct, and as they require a little explanation :—

1. That "it could not have been because Symington acquired by any *pecuniary means* an interest in the invention, that the patent for it was taken out in his name; for Symington was, notoriously and confessedly, a person without money."

2. That "the monied person in the business, or, at least, the person who procured from others the money to take out the patent, was Taylor."

3. That "he (Taylor) was also the person who introduced Symington to the influential patronage of Mr. Millar, of Dalswinton; and it seems to have been on these grounds—partly pecuniary considerations and partly gratitude—that Symington covenanted to assign to Taylor one-half of the fruits of his invention."

I. That "it could not have been because Symington acquired by any pecuniary means," &c.

The truth is, that when Mr. Symington took out the patent for his steam-engine—the same which he used in his steam-boat experiments in 1788—Mr. Gilbert Meason, the manager of the Wanlock Head Mining Company, in whose employment Symington was, supplied the necessary funds. Mr. Symington afterwards constructed an engine for that gentleman, for which engine, through motives of gratitude, he neither would nor did receive any premium during the whole term of years for which his invention was protected. So far, too, from Mr. Symington being "notoriously," or "confessedly," a person without money, he was, as may be seen by the following extract from a letter which he addressed to the editor of the *Caledonian Mercury*, in Sept. 1827, a person in easy circumstances—comparatively with Taylor, at least :—"It is not true," he says, "that I had pecuniary difficulties to struggle with while making the experiments on Mr. Millar's boat; for, during all that time, I was in the service of the opulent Wanlock Head Mining Company." In another passage of the same letter, he says: "I admit that Mr. Millar furnished the boat, and defrayed the price of the ma-

chinery, at this time, 1788, and also of the second experiment at Carron, in 1789; but I decidedly and pointedly refuse, that Mr. Millar ever remunerated me in any way for my personal trouble and expense; in fact, the experiments cost me more expense than they did Mr. Millar, to say nothing of my anxiety and devotion to carry them into full effect."

It is, therefore, evident, that although Mr. Symington was not rich enough to introduce steam navigation unaided, yet that he was not "notoriously and confessedly a person without money."

II. "That the monied person," &c.

Instead of Taylor being a monied person, he was notoriously and confessedly poor. It is allowed, even by the "accurate Chambers," as Mr. Allan Cunningham calls him, that he accepted the humble situation of preceptor in the family of the late Patrick Millar, Esq., of Dalswinton, "because he had made the important discovery, that the ardour of enthusiasm, however it may sustain the mind, will not support the body." Neither did Taylor procure any other person, who had money, to take out the patent; for, as already stated, the gentleman who actually advanced the money was Mr. Meason, Symington's employer and patron.

III. "He also was the person who introduced," &c.

Mr. Millar's visit to Mr. Meason's house to inspect Mr. Symington's steam-carriage model, was in consequence of having been informed by Taylor of the existence of such an invention. For the results of the conversation which took place between Messrs. Millar and Symington on that occasion (see No. 511 of the Mech. Mag., and my pamphlet, published last summer). Suffice it to say on the subject of Mr. Millar's "influential patronage," that Mr. Symington, as has been shown, declared, during Mr. Millar's life, that the experiments had cost him more than they did Mr. Millar—a declaration which was never contradicted; and that the late Mr. Joseph Stainton, manager of the Carron Company, made affidavit that the sum paid by Mr. Millar, for the construction of the machinery at Carron, amounted only to 363*l.* 10*s.* 10*d.*, which sum, by-the-bye, Taylor represented Mr. Millar as deeming excessive.

Having endeavoured to set you right on these points, I shall now proceed to throw a little light on Mr. Symington's letter to Taylor, a document to which so much importance is attached by Chambers. It refers, it will be observed, to a "former agreement;" but no such agreement has ever been produced, though often asked for, and the relatives of Mr. Symington have every reason to believe that it never existed. As to the letter quoted, too, their conviction is, that generosity and friendship practised upon by artifice and cunning, were the sources from which it originated. Be that as it may, I am prepared to prove that the transaction, as detailed by Chambers, is a discreditable fiction, got up for a treacherous and most unfair purpose. I hesitate not to pledge myself to the public, that if any further provocation be given, by insulting the memory of my relative, I will lay open such a scene of deception, practised by Taylor and his representatives, as will increase the sympathy felt for the misfortunes of Mr. Symington, cover with disgrace the name of Taylor, and for ever silence and put to shame his short-sighted supporters.

In your enumeration of the causes of the slow acknowledgment of Mr. Symington's claims, no slight knowledge of the human mind is evinced, and I perceive it has been your wish to deal leniently with the Messrs. Chambers; but how far these gentlemen are entitled to leniency is questionable. Their motives are best known to themselves; but, to every well-constituted mind it must appear irreconcilable with honourable dealing, to calumniate the character of an individual sleeping in the dust, and refuse to examine the proofs which clearly point out that he has been treated with injustice. The Messrs. Chambers cannot deny that they were informed that their Biographical Sketch of Taylor was incorrect. A letter to that effect was sent to them twelve months ago, containing a few questions, which, to this day, remain unanswered; and, besides this letter, my pamphlet was offered to one of the Messrs. Chambers, by a respectable gentleman, a resident in Edinburgh, with a request, assuredly not made by me, that he would re-consider the subject. What was the answer? Why, that he "would not again stir up the matter." And this, forsooth, is editorial justice on the north of the Tweed.

Before concluding, it may not be amiss to point out what seems to have been the *animus* which actuated the parties concerned in these transactions.

Mr. Symington, young, unsuspicious, confiding, generous, and just, moved by the enthusiasm appertaining to genius, looked forward to fame, fortune, and success, from the prosecution of his plans. Mr. Millar, well-intentioned, but versatile and visionary, indulged in idle, unprofitable dreams, and, it is not at all improbable that, like other men of weak minds, he was easily prejudiced against the deserving, and made the dupe of the designing. Taylor—cunning, but not wise—seems not on any occasion to have let slip an opportunity of enhancing his own importance in the eyes of those who would be imposed upon by pretence. Servility and cupidity were prominent traits in his character, and he does not appear to have deemed it necessary that truth should be resorted to on every occasion. From the former arose his fitness for the honourable duty of espionage, when he had succeeded in exciting suspicion in the mind of Mr. Millar against Mr. Symington, while the latter was employed at Carron in constructing the machinery for the boat fitted up in 1788. And to the latter we may ascribe the many unfair practices and mendacious stories by which he sought to bolster up his most unfounded pretensions.

I am, sir, with much respect,

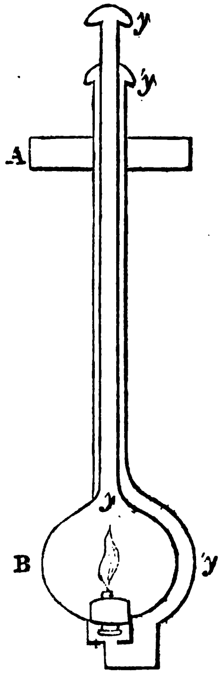
Your most obedient servant,

ROBERT BOWIE.

74, Bishopsgate-street Within,
May 6, 1834.

FISHERMAN'S LAMP.

Sir,—The following sketch represents a plan for giving more effect to an artifice familiar to the fishermen of most countries. Torch-light is commonly used by fishermen as a lure; the figure accordingly represents a lamp intended to burn some feet under water, and to serve the purpose more effectually. B is a strong glass globe containing a lamp, connected with 2 tubes, one about 8, the other about 10 feet long. Y Y the longer one passes from the top of the lamp to take off the impure air; its top has a cover after the manner of lanterns, to keep the wet out. Y′ Y′ the shorter, includes the other for



most of its length; it admits fresh air to the bottom of the lamp. A is the section of a cork float, which suspends the light at the depth of about 5 feet from the surface. I am, sir, yours, &c.

φ. μ.

[Having announced the substance of the preceding communication in our Journal of the 5th April last, we have since received the following from another correspondent.—ED. M. M.]

Sir,—I should be much obliged to φ. μ. to inform me, through the medium of your useful periodical, whether he has tried, and found to succeed, the fisherman's lamp, mentioned in your last Number as having been contrived by him.

The idea of having such a lamp constructed, occurred to me about nine months ago, and indeed such an idea would naturally present itself to any one who is familiar with the fact that fish are attracted by light, and who is devoted to

that department of fishing, with which alone such facts are concerned.

The uncertainty of success, and other avocations, prevented me from pursuing the idea I had conceived, and I should be glad to be informed whether the plan *depends for its success* (if it be successful) upon any contrivance not contained in the plan I proposed to myself, which is as follows:—Provide a net in the shape of a bag, about six feet in diameter, of a small mesh, and deep enough to admit of its mouth being drawn close by a string run through the top meshes, without contracting its diameter, which is to have its shape and size preserved by means of a hoop.

In the centre of this open bag is to be placed a tin tube, to the lower end of which is to be connected a glass tumbler, furnished with a suitable lamp.

The tin tube must have a screw-joint a short distance from the glass, to allow of easy access to the latter, and small tubes (also of tin) must be soldered to its sides, and communicate with the lamp at one end and the external air at the other, that the light may have an ample supply of its essential nourishment.

The whole apparatus is to be placed at the bottom of the water, and to be drawn up (from a boat) by the string before mentioned, at intervals, as the operator may think fit.

H. P.

Canons, Edgware, Middlesex,
April 9, 1834.

"ANCIENT AND MODERN LEGISLATION." *

That the much-vaunted wisdom of our ancestors covered a great deal of absurdity and folly, is one of the prevalent notions of the day, the soundness of which we are by no means disposed to impugn. Next, however, in pernicious influence to a dogged adherence to old modes and practices, simply because they are old, is an excessive fondness for innovation, from a blind contempt for every thing wearing the rust of antiquity. Bacon defines well the just medium between these two extremes of conduct, where he says—" Antiquity deserveth that a man should make a stand thereat, but having found the right way, *then make progression*." Now, to point out this " right way"—to show how far our forefathers have advanced in, and how far departed from it, and this by a clear exposition of principles, illustrated by apposite examples,—is to perform a double service to the cause of " progression," or, as it is now more commonly called, " the movement," since it must at once help to convert the stubborn, and to restrain the precipitate. The Lecture before us offers no more than a slight sketch of what is to be done in this way; but, so far as it goes, it is deserving of great praise. The doctrines propounded are all perfectly sound; the facts selected for illustration of a very striking description; the commentaries of the author dispassionate and judicious; and his general manner engaging and persuasive.

That it is of the nature of things that mankind should emerge from a state of darkness into still greater and greater light, is very happily illustrated by the following remarks:—

" The truth is, that wisdom has never been the possession of ancestry, but always the slow accretion of the mental riches of posterity. The sources of knowledge have been stated to be intuition, observation, experience, and testimony: of these only the first and the most questionable is equally open to the most remote ancestry. The others have, through every successive generation of men, accumulated the stores of past ages to enrich the present. One of the most prominent of the distinctions which subordinate animals to men, is, that the experience and the discoveries of one individual cannot be communicated to its successors. With them posterity all start from the original level; nothing can be added to the knowledge of an individual, but the discoveries of a single life. With respect to man, on the other hand, all the acquirements of an individual become immediately part of the common property of society. The most valuable discovery is poured into the stream of knowledge, and enriches and augments it as it floats down to the succeeding generation. Thus what in one age is the happy and bold speculation of a master mind, is, in the next, the common property of all educated men. The discoveries of Newton are, in the next age, part of the acquisitions of every senior wrangler. The steam-engine, which occupied the life of Watt to perfect, can a few years

* The Substance of a Lecture on the Contrast between the Spirit and Objects of Ancient and Modern Legislation, delivered before the Royston *Mechanics' Institute. By J. P. Wedd. Royston Press. 1834.*

after be constructed by almost every mechanist. Every generation starts in the extent of its knowledge, from the point where the preceding one left off. The acquisitions of science are like the discoveries of an unexplored country; what has been already mapped and surveyed, is to be deducted from the labour, and added to the knowledge of subsequent explorers. It is true there have been exceptions to this progression in the history of mankind. Such was probably the Deluge; such we know to have taken place on the irruption of the northern barbarians over the Roman empire, and such, in a limited degree, was the situation of Egypt, when the baths of Alexandria had been lighted for six months with the manuscripts of the library of all the Ptolemies. These exceptions, however, do but prove the rule. When an individual professes his respect for the wisdom of our ancestors, we are tempted to ask him, whether, if he wanted a steam-engine, he would order one to be constructed on the model of the original one in the Tower, the exemplification of the original idea of the Marquis of Worcester, or whether he would go to the Soho manufactory, and order one of the latest patent, with every modern improvement, and we would take his answer as the real test of his opinion."—pp. 29, 30, 31.

Of the meddling-to-mischief-spirit which distinguished the ancient legislation of this country, we have the following amusing summary:—

"The language in which their regulations were expressed was indeed concise, but the objects of legislation were most multifarious. They regulated the terms of contracts, the processes of manufactures, the obligations to labour and the amount of its requital, and the performance of the duties arising out of the relations of social life. They declared the truth or falsehood of opinions even on the subject of revealed religion, and it was never doubted that belief could be regulated by the decisions of the legislature. They extended to the minor morals, to duties of imperfect obligation; they condescended to prescribe dress, and to regulate amusements. The extent of these spheres of legislative duty, may have been derived as well from total ignorance of any rights in the common people, as from the patriarchal origin of civil government. When the sovereign, who is now contented to be the chief magistrate of the country, considered himself the father of the community, he naturally took on himself the duties of that relation. It has been the course of modern legislation to abandon one after another of these fields of duty. Some of the *subjects of ancient legislation* are left *to individual choice, as matters* which no considerations of the general welfare make it necessary to sacrifice on the altar of the public will. Others are referred to the tribunal of public opinion. Some were given up as unauthorised invasions of the undelegated authority of God; others, perhaps the most slowly receded from, were abandoned because they arrayed in a rebellion, always in the end successful, the intractable power of conscience. No idea, however, arose in ancient times of a limit to the power of the legislature, and if the benevolent wish of Henry IV. of France, that every peasant in his dominions might have a fowl in his pot for dinner on Sunday, had occurred to any of our Plantagenet or Tudor monarchs, we should probably have found it imperatively embodied in a short act of parliament."—pp. 8, 9.

Take in addition a few curious instances:—

Laws to restrict the use of Tools and Machines.

"In the 5th and 6th years of Edward VI., however, an act passed for pulling down gig mills, in the manufacture of cloth; and in the 2d and 3d of Philip and Mary, an act was passed, declaring that no cloth-maker should have more than one woollen loom, and no woollen weaver more than two looms, in unincorporated places. The effect of these laws was to prevent the expeditious performance of work, and to restrain the division of labour. If every weaver was to be the proprietor of but one loom, he must unite in himself the character of buyer and seller, with that of the operative manufacturer; a portion of his time must be given to the duties of that situation; he could, consequently, effect less in his manufacturing department, and more individuals must be employed to produce the same quantity of the article. Under the modern system, the master manufacturer may have any number of looms, let them out to any applicant, supply them with the raw material, and receive back the manufactured article, which the undivided attention of the operative is given to produce. The effect of the two improvements which these enactments were intended to restrain, the employment of machinery, and the division of labour, are similar. Both economise labour. Both increase production and render it cheaper. Both attain by different processes the same end. The utility of machinery and the possibility of its too universal application, have been overstated, both by those who affirm, and those who deny the truth of these propositions."—pp. 12, 13.

Laws to regulate the Colours of Cloth.

"The wisdom of our ancestors, in the reign of Edward VI., appears to have been dissatisfied with the unnecessary varieties of colours,

and thought it a duty to expunge the superfluous ones. It passed an act, giving a list of the colours in which only cloth should be dyed. There was, however, some latitude in the choice, as the colour of a lion was one which was permitted. Whether they meant the natural hue of the inhabitant of Libya, or any other in which heraldry had blazoned him, does not appear. Probably, however, fashion was as supreme over legislation in 1552, as it is in the present day, and if we had the January number of 'La Belle Assemblée' for that year, we might possibly find in the winter walking dress, the legislators doing homage to the very colours displayed around the form of beauty, which they had directed to be superseded by the 'sad new colour,' or the 'iron grey,' or the 'sheep's colour,' the favourites of their legislation. In the latter part of this act the legislature appears to have had some misgiving that they had made trade an uncomfortable employment, for they enacted, that if any cloth-maker should, within a given period after it passed, leave off his trade without a license from three justices (one being sufficient to send to trial for murder), he should never after be allowed under an alteration of his circumstances to resume it." —pp. 19, 20.

Laws to prevent the use of Hops in Beer.

"The brewing trade may here detain us for a moment. In the reign of Henry VIII., the city of London petitioned parliament against the use of hops, as a noxious weed, and against the introduction of Newcastle coals. In the reign of Henry VI. an act was passed to restrain the excessive making of malt. In the 2d year of William and Mary, it was enacted that no home-brewed beer should be made in a town where there was a public brewer; and we are told by Mr. Locke, in his work on toleration, that, under the test act, the publicans were required by law to partake of the most solemn ordinance of religion, as a qualification for entering on their calling. Thus the way in which the wisdom of our ancestors regulated brewing was, in attempting to prohibit the use of hops, to lessen that of malt, and to discountenance home-brewed beer. The spirit of these departed acts for restricting the use of malt and hops has been supposed in later times to have haunted the scenes of their former regulation, to have walked in the breweries, to have hovered over the coppers, and presided over the processes of more modern establishments."—p. 28.

Law forbidding Merchants to make Profit!

"In the 37th of Edward III., a law was passed, enacting that merchants should not engross goods to sell again at a greater price. One would like to ask the wisdom of our ancestors, for what other motive than the one they repudiated, merchants would ever buy! It was also enacted, that no merchant should deal in more than one article, and that every one who had done so, should clear off all his stocks but one, before a day limited in the act."—p. 26.

Laws to punish Foreigners for enriching the Country.

"By a law passed in the 5th year of the reign of Henry IV., that foreign merchants who brought goods into England, should sell them in three months, without any regard to whether there was a demand for them or not. In the 6th of Henry IV. this law was repealed, but it was enacted that foreign merchants who brought goods into England, should not carry them away, but should leave them behind. Several other laws enacted, that when foreign merchants brought goods into England for sale, they should lay out all the money they obtained in buying English goods, and should carry no money out of the kingdom.—Another law, in the 8th of Henry VI., declared that Englishmen should not trust foreign merchants, and should only sell to them for ready money. This was speedily found to be very inconvenient, and another law was passed in the 9th of Henry VI., allowing Englishmen to sell cloth to foreigners at six months' credit."—p. 22.

We subjoin one extract more, which relates to a subject concerning which, we regret to say, there is nearly as much absurd prejudice existing among our manufacturers as ever. We allude to the exportation of machinery—for enforcing the old laws against which, committees were formed but the other day at Nottingham and Leicester, to the serious injury of some of the best artisans of the country, and to the certain detriment of those very manufactures in which the anti-exportationists themselves are engaged:—

"Another subject of legislation as to trade is the duty imposed on imported manufactures.—In examining the principles of ancient legislation on this subject, we are told, that in the earliest periods a duty of five per cent. was imposed equally on goods exported and imported. In imposing this duty the object of the sovereign was, probably, merely to obtain revenue, and the interest of the people was neither known nor inquired into in the imposition. It might be considered that goods imported could not bear a higher duty than five per cent., and that by extending the same duty to exports, the revenue could be doubled. The system has however gradually changed, and important impositions upon exported goods have nearly ceased. The principles which tended to produce this change

were early introduced. In the 39th year of Elizabeth, 1598, an act was passed, declaring that the importing foreign wool-carding implements had destroyed the livelihood of many makers of them in England, and their importation was totally prohibited. The restrictions on the exportation of goods have been since principally applied to the raw materials of our manufactured articles, as raw hides and wool; and to articles not completely manufactured, as white cloth, for as this would require dyeing, the dyers caused its exportation to be prohibited.—Another class of prohibitions on the exportation of goods was still less defensible. It included goods perfectly manufactured, but which were wanted for other trades, as clock-cases, watch-cases, and dial-plates. The legislature, by restraining their exportation, in attending to the interest of the general watch-makers, who wanted them to work up, *forgot that of the case-makers.* On the same principle the exportation of all metals was, by acts of Edward III., and several subsequent reigns, prohibited, except lead and tin, which formed at that time a large part of our export trade. The encouragement of mining produced the acts of 5th William and Mary, for the allowance of the exportation of iron and copper. Brass unmanufactured was not so fortunate, and its exportation continued to be prohibited."—pp. 17, 18.

RECENT AMERICAN PATENTS.

(Selected from the Reports in the Franklin Journal, by Dr. Jones, the Superintendent of the Patent Office at Washington.)

SPINNING MACHINES.—*Joseph Riptra.*—In the smooth cap used as a substitute for fliers, in what is called Danforth's filling frame, an attraction or adhesion of the thread to the surface of the cap takes place in certain states of the atmosphere, which occasions great difficulty in the spinning, and a frequent breaking of the thread. To obviate these evils the present patentee, instead of leaving the outside of the cap of a plain continuous surface, forms thereon three or four more beads, fillets, or rings, projecting about a sixteenth of an inch. Suppose, for example, there are three such rings, he forms one of them on the lower end of the conical cap, another on the upper end, just where it begins to curve in towards the spindle, and the third about two-fifths of the distance between the two former, measuring from the lower edge. The distance, however, is stated to be a point of no importance.

MACHINE FOR DOUBLING, TWISTING, AND LAYING CORDAGE.—*John Drummond.*—A main shaft is to revolve horizontally, and this is to carry three other shafts parallel to itself, and sustained upon arms projecting from it. Upon these shafts are to be placed the bobbins containing the yarn. A gearing of wheel-work gives motion to the main shaft by which the laying is effected, and also to the secondary shaft by which the yarns are levelled and twisted. The cords are delivered by holes in the centre of the respective shafts, and the whole thus effected at one operation.

A specification for a similar machine, invented by a gentleman in Philadelphia, was sent over to England about seven years since, for the purpose of being patented here; but it was found that an apparatus, operating on the same principle, was in use in the ropery of the dock-yard at Woolwich, as well as in other places. The design of obtaining a patent was therefore abandoned.

PRESS FOR COTTON AND OTHER FIBROUS ARTICLES.—*Henry L. Conner.*—This press is intended to operate upon two bales at the same time. The pressure is produced by causing an endless screw to revolve vertically. This screw is of considerable length, and is fixed in the centre of the frame-work of the press, so that horses or other power may be applied to the lever by which it is turned. A stout nut is adapted to the screw, and rises or falls as it revolves, serving, by means of jointed levers, operating upon the principle of the toggle joint, to act upon a follower. The follower is a long beam, the ends of which work in grooves in the cheeks of the press, which are at a sufficient distance, on each side from the screw, to act upon a bale of cotton, placed between it and the bed. The levers which act upon the bed are on each side of the nut two in number, and they may be of equal length. They are connected with each other by a single joint; one of them also is united to the nut, and the other to the upper beam of the press in the same way. When the nut is down upon the follower, one of the levers lies upon it, and the other against the cheek of the

press, consequently they are then at right angles with each other. To cause the jointed part to slide readily over one follower friction-rollers are employed.

It is said, that with the power of the small horse thirty-four bales were pressed in a day, two at a time, so closely, that 530 lbs. were contained within two feet square. Twelve bales a day is considered to be fair work with the ordinary double-screw press.

We apprehend that a large portion of the advantage derived from this press results from the toggle-joint action. At first the cotton opposes scarcely any resistance, and the follower may then descend rapidly, which it will do by the action of the levers, whilst at the period when the greatest power is wanted their descent is proportionably slow.

HORSE-POWER FOR PROPELLING MACHINERY.—*Charles Keller.*—A lever, to which the horse is to be attached, is fixed to the vertical shaft of a cog-wheel, and the teeth of this take into an endless-screw, formed upon a horizontal shaft, which carries a band-wheel or whirl, a strap from which may be extended to drive machinery. The cog-wheel, and the horizontal shaft which it drives, may be placed below the horse-walk, and the apparatus be thus confined to a small space, and rendered portable. The claim made is to "the application of the well-known principle of the endless-screw and cog-wheel to a portable horse-power for driving machinery."

The advantage which may be expected to result from this contrivance, is the obtaining the required speed by no farther gearing than that described. The difficulty to be apprehended is the great friction to which the endless-screw must be subjected, which, if the materials are not extremely hard, and the rubbing parts are not constantly supplied with unguents, must soon wear it out.

The application of the endless-screw to a portable horse-power, is, we believe, new; it, however, has been used for driving boulters in flour-mills, and for other purposes. Mr. Nairne, the well-known philosophical instrument-maker of London, manufactured, about sixty years ago, many globe electrifying-machines, which were turned by a toothed-wheel, acting upon an endless-screw.

NOTES AND NOTICES.

An esteemed correspondent thinks "Mrs. Somerville has acted not very handsomely in describing Mr. Saxton's magneto-electric apparatus, inasmuch as she has omitted all mention of that gentleman's name, and has spoken of it as though it were merely an improvement on Mr. Faraday's methods, and put forward in detraction of his justly acquired fame."—"It was," he proceeds, "by its means that Mr. Saxton was the first person—in this country at least—to elicit the first spark from the magnet alone, while Mr. Faraday, however 'easy' it may appear to Mrs. Somerville, was unsuccessful in all his efforts to accomplish this point. The 'proof of the identity of the magnetic and electric fluids by producing the spark' was incomplete, till it was exhibited by means of this apparatus. Mr. Faraday expressed himself highly pleased with it, when it was shown to him at Cambridge, and has never manifested aught that is contrary to the kind and generous feelings congenial to his character, and so becoming in the eminent man of science."

A Subscriber, who is obliged, from the nature of his occupation as a brewer, to get up at all hours of the night, complains that his alarum often fails to awaken him, and that he has applied in vain to several watchmakers for some simple and effectual mode of producing more noise than is made by a common alarum. He hopes that some of our readers will be able to suggest a sufficient remedy, and we trust he will not be disappointed. If he should, however, we can refer him to an eminent mechanic, who invented a contrivance by which, when his alarum failed in rousing him of a morning, the bed-clothes were first dragged from his shoulders, and in the event of this failing also to bring him on his feet, a bucket of cold water was emptied upon him.

The Blackfriars-bridge Repairs' Committee have, we understand, resolved to enlarge the roadway to nearly the width of the New London-bridge.

If a "Labouring Mechanic" will favour us with a call in Peterborough-court, we shall be glad to furnish him with the information he requires.

The Abstracts offered by our esteemed friend at Lewes will be very acceptable.

Communications received from Mr. D. R. Saunders—Δ.—Mr. Routtem—J. P.—Mr. Cheverton—Mr. Busby—Mr. Mackinnon—P. H.—Mr. Bayley.

The Supplement to Vol. XX., with a Portrait, of William Symington, is now ready, price 6*d*.; also Vol. XX., complete, in boards, price 8*s*.

Errata in Mr. Cowell's Papers.

Page 42, col. 1, line 39, for "41 additional" read "57 additional."
— 43, — 2, — 6 from the bottom, for "conclete" read "correlate."
— 44, — 1, — 3, for "required a new bill" read "again cabal."
— 55, — 1, — 34, for "and 28 juvenile assistants, total 35 persons," read "and 21 juvenile assistants, total 28 persons."

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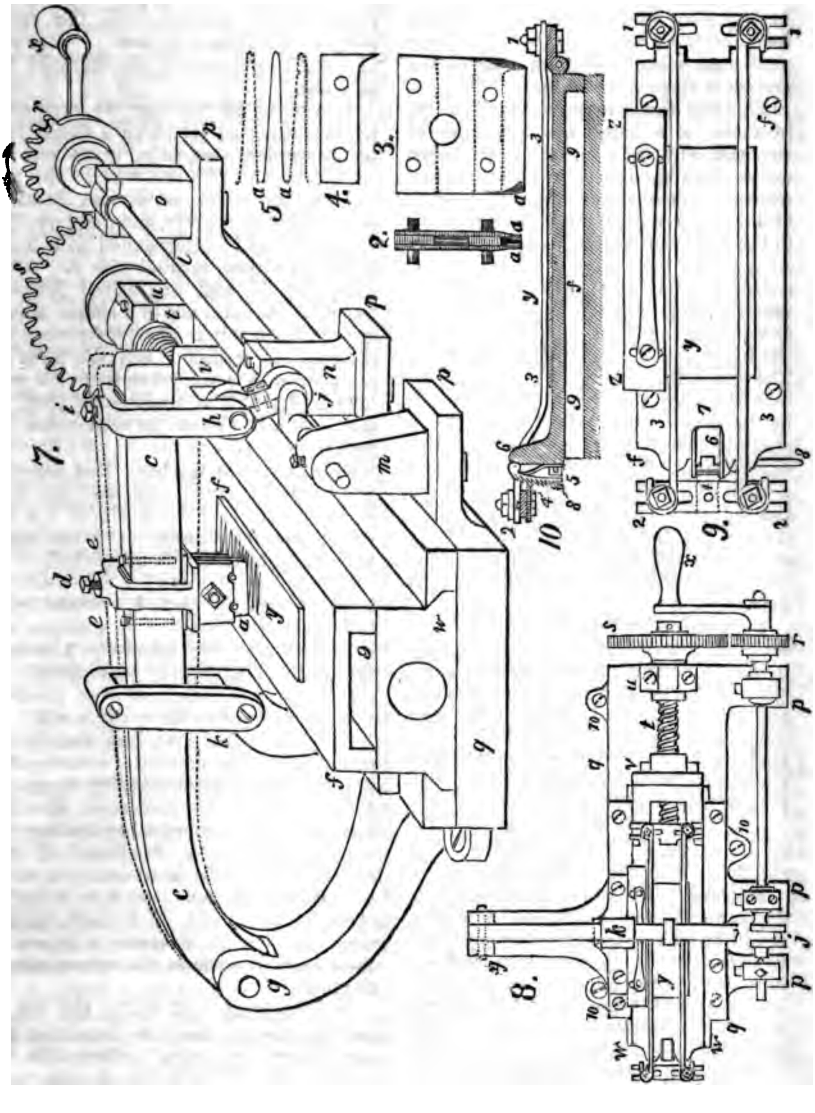
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 562. SATURDAY, MAY 17, 1834. Price 3*d*.

ROGERS' COMB-CUTTING MACHINE.



ROGERS' MACHINE FOR PARTING COMBS.

Materials for combs are,

1. Box-wood,
2. Ivory,
3. Horn, and
4. Tortoise-shell.

These being cut into pieces of the proper size, and the general form of the comb having been given to them by common tools, such as rasps, scrapers, &c., the next, and most important, part of the process is cutting the teeth.

This was formerly done, in all cases, by means of a double saw, consisting of two parallel blades, one of them being deeper than the other, so that when the deepest blade has cut to the whole depth of a tooth, the other shall have cut only to the depth of half a tooth. In using it, the deep blade makes the first cut at a little distance from the outside of the material, so that by the first action of the saw the outer side of one tooth and half the inner side of the same tooth are cut. The saw is then advanced one tooth, so that the deep saw rests in the cut made by the shallow saw, while this latter is ready to form half the outside cut of the second tooth. Thus the saw is advanced a tooth at a time, the intervals between the teeth are rendered equal, and half the cut for the deep saw being already made, the tool is prevented from swerving, or cutting teeth of unequal thickness.

Soon after the invention of the circular saw, it was applied to comb-cutting, by fixing on one axis two circular saws, one of greater diameter than the other, and regulating the distance between them according to the fineness of the teeth to be cut. Both the straight and circular double saws are now in use, the former being still applied to cutting combs out of all the four above-mentioned materials, the latter being used chiefly for combs of box and of ivory.

Box-wood and ivory, if subjected to the perpendicular action of a cutter, would break and splinter; but horn and tortoise-shell, being of a laminated texture, and capable of being rendered soft and flexible by heat, will yield in this state to the action of a sharp vertical cutter without splintering.

About twenty years ago the principal house in London, at that time for the sale of combs, had received from abroad some patterns of ornaments like the spikes and balls of coronets, to be attached to tortoise-shell combs.

They gave the order to execute these to an ingenious artist of the name of Ricketts, who contrived a punch, by the successive pressure of which on a thin piece of warm tortoise-shell he cut out the pattern, piece by piece. On disengaging the pattern from the other part, he observed to himself, "here are two combs cut out of the material for only one."

Improving on this hint, he soon contrived a machine in which a single cutter descended vertically, being put in motion by a treadle and wheel: the bed on which the tortoise-shell was fastened was notched at the side, and these notches fitted into and corresponded with those of a rack placed parallel with it. After every cut the bed was moved forward by hand the distance of a single notch, and thus an equal interval between all the cuts was secured. But the form of the tooth of a comb being that of a very long triangle, it was necessary that, as the bed was shifted forward notch by notch, there should also be an alternate motion given to the bed: this likewise was given by hand; and thus the first rude machine for parting combs, *i. e.* for cutting one set of teeth out of the intervals of another set, was completed.

When the knowledge of this machine began to spread abroad, various contrivances were invented to advance the bed, and give the necessary alternate change in direction, by machinery. In some cases this alternation was given to the bed, in some to the cutter itself.

Previous to this time, however, it had occurred to the original inventor, Mr. Ricketts, that the machinery necessary to produce this alternation of direction might be dispensed with, by making the cutter double, *i. e.* composed of two blades set obliquely so as nearly to touch at one end, and at the other to be as far apart as the width of a tooth, at the same time the blades made a return at their ends to liberate the extremities of the teeth.

It it evident that, while the cut is making, the material must be stationary, and that in the interval between the rise and descent of the cutter the bed must have advanced the breadth of a tooth. This was effected in Mr. Ricketts' double-

cutter machines by working the cutter alone by a treadle, and advancing the bed by a screw, to the end of which a winch was fastened, so that one complete or one half turn gave the necessary advance, a pause being made after each turn or half turn, to bring the bed to a stop while the cutter was in action.

Mr. Rogers' machine obtains this end without the use of a treadle, by means of a single winch. The axis to which the winch is fixed gives motion to the cutter by means of a crank, and on the axis is a wheel having part of the cogs removed; this wheel takes into a common cog-wheel on the axis of a screw, by the turning of which the bed with the work on it is moved forwards. Hence it is evident, that while the machinery for raising and lowering the cutter is in constant action as long as the winch is turned, the screw, which gives motion to the bed, is still and out of action during that part of the revolution of the winch in which the cogs of the two wheels are not bearing on each other. By enlarging the space from which the cogs of the second wheel are cut away, the interval between one tooth and another is diminished; so that any given distance of teeth may be obtained by putting on to the axis of the screw a wheel with the proper number of cogs.

The machines for parting combs, in all their modifications, have this advantage, of cutting two set of teeth out of the same quantity of material as with the common saw is sufficient only for one set.

But every scale of tortoise-shell is wedge-shaped at the margin, and therefore it is only to the thick pieces, cut out of the middle part of the scale, that this new invention can readily apply, for the wedge-shaped margin is not thick enough for the back of a comb. But, on the whole, the advantage as regards tortoise-shell is very great, for the prime cost of rough shell of fine quality is four guineas per pound,—a price greater than that of silver.

In many cases, however, the thin edge of a piece of tortoise-shell may be strengthened by soldering it to a thicker or larger piece for a back. This is done by heating the shell, and pressing it at the same time; but much care is required lest the shell be over-heated, in which case the lamellar texture is destroyed, and the substance becomes as brittle as glass. In Germany and in France many combs are made, the ornamental part of which is stamped by strong pressure in hot steel dies, and two or more pieces of tortoise-shell are united in the same manner; but the colour of shell so treated is injured, besides being rendered very brittle.

The best English makers, after smoothing and rasping the two surfaces that are intended to be united, place them between two thin boards, and insert the whole in the chops of a screw-press. The press is put for some hours into boiling water, and is tightened from time to time; and thus, by allowing a sufficient time, a perfect junction is obtained at a heat so low as not to injure either the colour or texture.

The following are the details of Mr. Rogers' machine, as represented in the accompanying engravings, and described in the Second Part of the Society of Arts Transactions for 1833:—

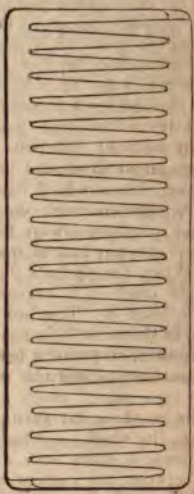
Fig. 1 shows two combs cut out of one piece of shell before they are pulled away from each other. The shell is held on a movable bed, which is caused to move the distance of one tooth each time; two chisels are used together, so that one complete tooth is cut at each move: the chisels or cutters are fixed together, as shown in figs. 2 and 3, with four pins, and filling-pieces are placed between, the thickness and taper of which are such as correctly to determine the form of the teeth. From the lower filling-piece (which is shown separate in fig. 4) a sharp point descends so as to be level with the edges of the cutter; it cuts the point of the tooth away from the opposite comb; but as this double chisel cuts the tooth of one comb and the space of the opposite one, their wider ends are curved out as at *a a*, fig. 5; by this the advancing side cuts half through the point of the next tooth, and at the second move the following curve cuts through the other half, and leaves that tooth detached. Fig. 6 shows the clamp in which the cutters *a a* are held by the screw and nuts *b b*; and as these cutters have to move up and down correctly in the same place, the clamp is firmly fixed (at the right place) by its binding screw *a* on the bar *c c* of the machine, fig. 7. *e e*, fig. 7, are two adjusting screws, by which the chisel-edges are placed correctly parallel with the bed *f f*, on which the shell is laid for cutting; *g* is the fulcrum on which

the bar *c c* moves; it is a well fitted joint, moving without shake, and placed level with the bed *f*; *h* is another joint very firmly clamped by its screw *i* to the front end of the bar *c*: and as here the power is to be applied to pull the cutters *a a* down to their work, these two joints, *g* and *h*, are placed in a line level with the cutting edges of the chisels *a a*; they are both, therefore, at the moment of cutting, level with the bed *f*; and this is evidently the best arrangement, for by it the chisels have then no lateral motion and no tendency to tilt aside; nevertheless, to over-rule all bias that might occur from unequal sharpness, or from any inequality in the substance that is to be cut, an upright loop or standard *k* is firmly secured to the machine;

Fig. 6.

through this loop the bar *c c* passes, and can move up and down in it without any side-shake; this, therefore, guides the bar *c*, and farther secures the uprightness and steadiness of the cutters. A link in two halves, and screwed together in the middle for the convenience of putting on, connects the joint *h* with the crank *j*, whose axis extends past *l*, and is supported in three standards *m*, *n*, and *o*; these standards are, for the purpose of adjustment, screwed to the projecting loops *p p p*, which, with the arm *g*, are cast in one piece with the lower bed *q*, so that the chisels are held and pulled with the greatest firmness to the cut. On the farther end of the cranked axis *l* is placed a wheel *r*, with only a few teeth left on it at one side; these are so placed as only to engage the wheel *s* when the crank *j* is up, and has lifted the cutters *a a* from the work; the wheel *s* is fixed on a screw *t*, fig. 8,* which moves the bed *f f* precisely like the usual slide-rest: *u* is the standard in whose collar the screw *t* is held, and *v* the screw-hole through which it passes; this is united to the dove-tailed slide *w*, on which the bed *f* is mounted; this slide is perforated to make room for the screw *t*. By turning the winch *x*, the crank *j* pulls down the cutters *a a* on the tortoise-shell *y*, and cuts one tooth; the crank then lifts up the cutters, and at the same time the few teeth on the wheel *r* engage and carry with it the wheel *s*, and thereby advance the screw *t* a given portion; the wheel *r* then quits its hold of *s* and the crank, and again brings

Fig. 1.



down the cutters to form a second tooth, and so on till the whole number of teeth are cut; this done, another piece of shell is laid on the bed, and it is cut during the return of the bed by merely turning the winch *x* the contrary way, so that no time is lost.

Having now described the motion of the cutters and the motion of the shell past them, it is necessary to explain the means of holding the horn or shell to the bed. This apparatus was purposely omitted in fig. 7, and figs. 9 and 10 are added to show it. *f f* is the bed, at one side of which an adjustable plate *z z* is screwed, for the purpose of guid-

* In this fig. the end of the bar *c* and its connecting link are broken away, in order to show the crank *j*.

ing or securing the shell, to be quickly placed central and parallel; to one end of the bed is jointed the double fork 1 1, and at the other end is a similar double fork 2 2, but quite loose: 3 3 are two slender steel springs or bars; they are bent at each end like hooks, by which they are attached by screws and nuts to the jointed forks 1 1 at one end, and to the loose forks 2 2 at the other: these forks keep the two bars parallel, and by them they may be adjusted to any suitable distance apart, which should be as near to the cutters *a a* as may be without touching them. These springing bars being thus jointed to the bed at 1 1, may be lifted by the other end to place the tortoise-shell under them; then, to keep the end 2 2 down, a wide tooth 4 projects from the middle of the forks 2 2: it snaps past the flutes of a pendant catch 5, by which it is retained, and thereby the springs 3 3 are held with any required tightness on the tortoise-shell *y*. The catch 5 is jointed at the top to a stud 6, and is pressed outwards against the tooth 4 by a small spring, as shown in fig. 10. Again, it is requisite that the springs 3 3 should always go down correctly in the same place, that is, parallel with the bed *f*, otherwise the cutters might come against them and be damaged; therefore, two thin cheeks 7 7 are attached to the stud 6, between which the wide tooth 4 passes, and is thereby always kept central, and thus prevents any lateral motion of the bars 3 3. When the springs 3 3 are to be lifted up, the catch 5 is pressed from the tooth 4 by a lever 8. The bed *f* is hollow underneath, as shown at 9, in figs. 7 and 10, for the purpose of receiving a heater during the time of cutting, as warmth renders horn or shell soft.

To set the machine for cutting finer or coarser teeth, the wheel *r* is changed for another with fewer or more teeth, and the filling pieces between the cutters are changed for others whose thickness answers the required tooth; these when once made, may be marked with the same number as the wheel *r*, to which they correspond. The inside faces of the chisels, or cutters *a a*, are kept quite flat and perpendicular, so that the tooth never sticks between them, and the taper for sharpening them is all on the outside.

By the simple action of this machine combs may be cut as fast as the workman can attend to them.

It is requisite, for the convenience of the workman, to cause the bar *c* either to rise up of itself, or to keep up when put so; for this purpose, it is but to fix the winch handle *x*, as in fig. 8, opposite to the crank *j*, and make it heavy enough always to descend, and thereby lift the bar *c*; or a spring may be fixed on the arm *g*, to act against the under side of the bar *c*, with sufficient force to raise it up, or at least to hold it up.

Figs. 1 to 6 are half the size; figs. 7, 9, and 10, are one quarter; and fig. 8 is one-eighth; in this figure are shown three ears 10 10 10, they project from the bottom plate *q* of the machine, and serve to screw it to any suitable bench.

ON THE DISADVANTAGES OF PURCHASING COAL BY MEASURE.

Sir,—That part of the coast of England on which I reside is supplied with coal from Newcastle and its immediate neighbourhood. The coal which has come under my notice, and to which I have directed particular attention, has been of six kinds, viz.:—

Lambton's Primrose,
Old Eden Main,
Seaham Main,
Russell's Lyon's Main,
Orde's Redhaugh,
Charlotte's Main.

The specific gravity of coal differs materially. In the above list the different kinds are placed in the order they have been found to occupy in this respect,—the specific gravity of Lambton's Primrose being the least, that of Charlotte's Main the greatest.

As the design of this paper is to invite attention to a subject of some importance in the every-day transactions of life, I do not consider it necessary to enter upon any scientific details, which belong more especially to the geologist or mineralogist.

At all the outports Newcastle coal is sold by measure; the provisions of the late coal-act extending only to the port of London. Different customs prevail at different ports. In some places coal is measured to the merchant or consumer by lighters or barges, their cubical contents being first ascertained and registered. In other places carts are employed, whose contents are registered in a similar manner. At one port in this neighbourhood a measure is used, called a bushel, whose capacity is equal to two imperial bushels. In the majority of cases, I believe, the standard imperial bushel for dry goods is that employed for measuring coal at its first delivery from the ship, and subsequently at the merchant's yard.

Formerly, the chaldron of Newcastle coal was considered to average 27 cwts. =84 lbs. avoird. per bushel. The standard London chaldron now weighs, in practice, 25½ cwts.; but it ought to weigh 1 ton 5 cwts. 2 qrs. 24 lbs. = 80 lbs. avoird. per bushel.

Mr. M'Culloch, Dict. Commerce, Art. Weights and Measures, page 1103, speaking of the Act 5 Geo. IV. c. 74, says,—"The greatest blemish, by far, in the new Act, is the continuance and legitimation of the practice of selling by heaped measure. We are astonished at the toleration of such a barbarous custom. All articles that may be sold by heaped measure *ought* to be sold by weight. In Scotland, indeed, the use of heaped measure was legally abolished above 200 years since; and the present ill-advised attempt to revive a practice productive of nothing but fraud has been universally rejected in that country."

The directions in the above Act for using the imperial heaped bushel, after describing its form and dimensions, are as follow:—"In making use of such bushel, all coals, and other goods and things commonly sold by heaped measure, shall be duly heaped up in such bushel, in the form of a cone, such cone to be of the height of at least 6 inches, and the outside of the bushel to be the extremity of the base of such cone; and that 3 bushels shall be a sack, and 12 such sacks shall be a chaldron."—§ 8.

If any one interested in this subject will take the trouble to observe attentively the process of measuring coal, by the bushel, from the ship, as it is usually conducted, he will have no difficulty in understanding that it is much easier to prescribe rules than it is to practise them.

I have never found that 80lbs. of coal, even of those kinds whose specific gravity is the least, measures more than a bushel. A fair average of large and small together is, of course, here intended. With 80 lbs. of entirely large coal, the bushel will appear fuller than with the same weight of small coal, or of a mixture of small and large in proper proportions. Either extreme I hold to be objectionable. The fairest rule is to deliver the coal in the same proportions of small and large as they average throughout the cargo; and it is the wilful or accidental disregard of this rule that occasions considerable loss to the merchant or the consumer, but generally the latter.

I come now to the results of my own observations on this subject:

(1.) August, 1833.—Lambton's Primrose, 36 bushels, taken indiscriminately, at uncertain intervals, and on different days, from 50 chals., each bushel being weighed separately,—

Maximum.......... 79 lbs.
Minimum 65
Average per bushel 72·222 lbs.

(2.) August, 1833.—Seaham Main, 27 bushels from 40 chals.

Maximum.......... 79 lbs.
Minimum 68
Average per bushel 73·925 lbs.

(3.) March, 1833.—Old Eden Main, 25 bushels from 12 chals.

Maximum.......... 78 lbs.
Minimum 64
Average per bushel 72·545 lbs.

(4.) Feb. 1834.—Lambton's Primrose 15 bushels from 15 chals.

Maximum.......... 79 lbs.
Minimum 66
Average per bushel 72·875 lbs.

(5.) April, 1833.—Lambton's Primrose, 18 bushels from 20 chals.

Maximum .... 78 lbs.
Minimum 65
Average per bushel 73·133 lbs.

It is unnecessary to multiply instances. I have memoranda of observations on the other kinds of coal—but as smaller quantities were operated upon, the results may not be considered so satisfactory as in the cases already quoted.

In proof that, under the existing system, the loss in *measure* to the consumer corresponds very nearly with the loss in *weight*; and in proof also that the average obtained by selecting a bushel at uncertain intervals, is a fair approximation to the average of the same number of bushels taken consecutively, I view the following experiment as worth recording:—

(5.) Lambton's Primrose, 18 bushels, taken consecutively as delivered by the meter from the ship, thrown in a heap and carefully re-measured. The 18 bushels produced 16 bushels and 3 gallons, showing a loss, by measure, of 1 bushel and 5 gallons; and by weight, taking the average as before quoted ($73·133 \times 18 = 1316·394$ lbs.), $80 \times 18 =$

1440 — 1316·394 = 123·606 lbs.; or 1·5457 bushels.

An article so important as coal to our domestic comfort, and so essential to all the grand purposes of steam locomotion, artificial light, and national manufactures, should be subject to no restraints in respect to the mode of transit—should be placed beyond the reach of monopoly, whether arising from petty jealousies or aristocratic pride; and should, moreover, be liable to none of those flagrant abuses which are inseparable from the present system of delivery to the consumer. Taking the foregoing observations as data, it will be found that the average loss sustained, on the several kinds of coal I have enumerated, is very nearly 9 per cent.

Δ.

MECHANICS' INSTITUTION LECTURES.

Sir,—Colonel Torrens, it appears, is about to follow the example set by Sir Robert Wilmot Horton a year or two ago (just previous to his leaving England to take possession of his post as governor of Ceylon), by delivering a course of lectures to the members of the London Mechanics' Institution, on "the causes which regulate the value of the wages of labour." Yet, notwithstanding these two authorities in favour of the practice, it may very fairly be doubted whether political economy is a fitting subject to be handled in popular lectures. The extensive and abstruse nature of the science, and its utter inaptitude for illustration by experiment, seem at once to point out the necessity of its cultivation in the quiet of the study, rather than amid the uproar of the crowded theatre. The Colonel's prime object is to convince his hearers of the utter futility, *in natura rerum*, of the Trades' Unions, or any other species of combination among working men. But is lecturing the way to do this? Are those men, whose minds can be convinced by the few passing, half-forgotten words of a lecturer, who has "all the say to himself," worth the trouble of convincing at all? If they are, it is now too late, for they must have made up their minds long ago, after hearing the very eloquent, impartial, and dispassionate harangues of a gentleman, who preceded both Sir Wilmot and the Colonel, at Southampton-buildings, the *celebrated* Mr. Thomas Hodgskin!

The mania for taking a short cut to knowledge, by the hearing of lectures, has, indeed, now risen to so great a height, that not a moment's consideration is ever given to the question—whether the subject is a proper one for the purpose? All seem to be regarded as equally eligible. This is, certainly, no trifling mistake; and, unfortunately, our Mechanics' Institutions, which might be expected to stick more closely to scientific subjects than the similar establishments of a more general and "*genteel*" character, have gone as far out of the road as the best—or the worst—of them. Thus, at some that might be named, the mechanic has been enlightened by a series on such very edifying and instructive matters as "The History of Chivalry," or "The Poetry of the Middle Ages,"—glaringly inappropriate as they are, and thoroughly unsuited for the purposes of the lecturer, from the impossibility of exciting the hearer's attention by striking experiments, owing to their *unexperimental* nature. More ridiculous fooleries even than these have been sometimes perpetrated:—a dry old Chancery barrister has been engaged, and that, too, at institutions, not a hundred miles from the metropolis, in diffusing useful instruction in "science," by the delivering of certain very grave lectures on the important subject of—laughter,—duly interspersed with a very extensive, if not judicious, selection, of the most venerable Joe Millers in existence! What would our *simple ancestors* have thought, could they have foreseen so much of the march of intellect as this!

Greatly as lecturing has progressed, in quantity, within these few years, a great deal might still be done in the improvement of the article in quality; but the first thing to be effected should be, the banishment from the theatre of all those subjects—an immense number—on which more information might be gained by reading for an hour, than by dancing attendance on "a very nice man" for a month. Those retained would be, of course, only those which require an expensive apparatus for their illustration, or which admit of very striking exemplifications of the facts laid down—such, for instance, as astronomy and chemis-

try. Even the lecturer on the latter science, the best adapted, perhaps, of all, for display before a large assembly, finds many difficulties in his path. An experiment which succeeds perfectly in the laboratory, sometimes, from the heat of numerous breaths, or other causes, fails entirely in the well-filled lecture-room—and thus a fact, which ought to have been irrefragably *proved*, is left a bare *assertion*, and the almost solitary advantage possessed by a lecture over a pointed essay is wholly lost. This is not, by any means, a slight drawback, for it often happens that the failures are more numerous than the successful attempts. There is no danger of these mishaps, indeed, in lectures which consist of "all talkee-talkee;" but then, as these possess no advantages whatever, the exemption is of little consequence.

It might, perhaps, be a good thing to introduce an article in the rules of Mechanics' Institutions, excluding all lectures on subjects not strictly scientific; with a special proviso into the bargain against political economy, however high in the world the lecturers might be.

I remain, sir,

Yours, respectfully,

F. H.

London, May 8, 1834.

ROTATION OF THE EARTH.

Sir,—I have derived much pleasure and instruction from the perusal of Mr. Lyell's interesting work on geology, and have been duly impressed by the force of reasoning through which the author arrives at the conclusion, that the amount of depression of the more ponderous elevated parts of the earth's surface exceeds that of the elevation of similar depressed parts. It also seems probable that, from the escape of internal heat, the dimensions of our planet have in some degree contracted, and that they may be still in an actually contracting state. This supposition, however, and also the opinion that the amount of the depressions on the earth's surface exceeds that of the elevations, is opposed, as Mr. Lyell observes, by the arguments of La Place, who shows that such a circumstance could not occur without a sensible diminution of the period of the earth's diurnal rotation, such mechanical effects being the necessary consequences of a given rotary impulse imparted to a body whose quantity of matter, and of course of inertia, remains undiminished, notwithstanding its dimensions may have contracted. This would *seem*, indeed, to amount to a proof that both the opinions alluded to, however plausible they may appear in theory, and however countenanced by other circumstances, are really unfounded in fact.

But there is a circumstance attendant upon the rotation of the earth, of which I have not observed any notice to have been taken by philosophers, which it appears to me *must* have a constant, though minute, tendency to *increase* the period of the earth's diurnal motion; and if this tendency to increase that period should be equal to the opposite tendency proceeding from the causes spoken of in Mr. Lyell's work, the two tendencies would balance each other; or, if unequal, the *difference* only would have to be accounted for. In the case of equality, the arguments of La Place, as opposed to Mr. Lyell's hypothesis, are superseded, and if unequal, the difference may be so minute as not to be sensible during the period adverted to by the late distinguished philosopher of France.

In order to put my ideas in a clear point of view, let our planet be supposed to consist entirely of fluid matter, and revolving as at present, in that case the attraction of the moon would always cause the diameter directed towards that satellite to be greater than any other, and every particle of the whole fluid mass would, with respect to its own centre, be in a constant state of alternate elevation and depression; these alternations, it is true, would, in a gravid point of view, balance each other, but there would be nothing to compensate the loss of *mechanical power* proceeding from the *constant friction* of the particles of the fluid among themselves. Now, as this friction must always operate as some impediment to the change of figure constantly taking place in the fluid planet, as regards the relative position of its component particles; and as that change of shape is an unavoidable concomitant of the diurnal motion, and also as it is clear that the loss of power by the friction above mentioned must be at the expense of some existing mechanical power, and as there is no other mechanical

power involved in the question than that of the planet's rotation, it is obvious that it must be at the expense of that rotative power, and that it must therefore have a constant tendency to diminish it; or, in other words, to cause the fluid planet to revolve in a longer diurnal period.

Again, if enclosed within the fluid mass there be supposed a solid sphere revolving with it, an analogous effect will take place, though not precisely similar; for, though the *fluid* mass will be less, there will be an additional ingredient involved, namely, that of the friction of the fluid upon the solid sphere, as the fluid changes its relative figure; and, further, if the sphere be supposed to have certain protuberances* projecting through the fluid, the operation of these will render the analysis still more complicated. Still, however—referring to the first principle—notwithstanding, in this latter case, we shall find the elevations and depressions of the fluid balance each other, the *friction* of the moving particles among themselves, and against the inferior and protuberant parts of the solid sphere, *must be* at the expense of the rotary motion of the planet. On this course of reasoning I find myself impressed with the idea that the frictions attendant on the tidal action of the ocean *must* have a tendency to diminish the period of the earth's diurnal motion—and if this tendency to diminish the period of the earth's diurnal motion should equal, or nearly equal, the opposite tendency, arising from the causes pointed out by Mr. Lyell, his position and that of La Place's may both be perfectly correct, notwithstanding they may be apparently opposed to each other.

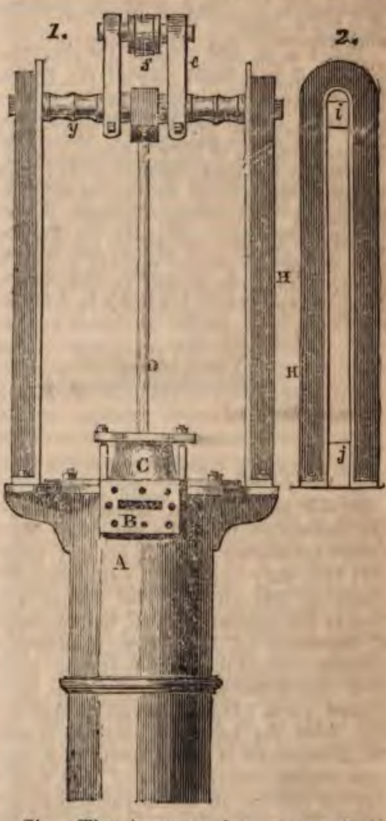
I have long entertained this idea as to the loss of the earth's rotative power from the tidal frictions of the waters among themselves, and against the shores and bottom, and conceived that in the lapse of so long a period as that alluded to by La Place, it must have become sensible, which is, I believe, not the case; if, however, the expectation of an *opposite* effect is countenanced by Mr. Lyell's well-founded supposition that the bulk of the planet is diminishing, and its density increasing, the consequence of that diminution in bulk would probably compensate the sensible effect of aquatic friction, and the two hypotheses would in that case seem to countenance and support each other.

I have the honour to be,
Your very obedient servant,
C. A. Busby.

Stanhope-place, Brunswick-terrace,
Brighton, May 1, 1834.

* Such as the continents, islands, &c. &c., of our globe.

SUBSTITUTE FOR THE PARALLEL MOTION.



Sir,—The beam-engine, or, as it is called, condensing-engine, is that generally used in this country, and one of its most essential parts is the parallel motion. To form this motion, four wrought-iron rods are usually made, with apertures in the ends of them, to receive brasses for their bearings. These bearings are eight in number, and require

to be fitted with the utmost nicety. Keys and wedges are also requisite to keep them in their proper places. But although great care and skill are generally shown in their construction and adjustment, the quantity of friction is still so considerable, as to be a serious drawback on the efficiency of the engine. I beg, therefore, to submit to the consideration of your readers a remedy for these complicated levers; it is similar in principle to the guide used in high-pressure engines, and will be easily understood by reference to the accompanying figures.

Fig. 1 is an end view of the engine, and fig. 2 is a front view of the guide (the other parts it is unnecessary to represent). In fig. 1 A is the steam-cylinder. B a steam passage. C the stuffing-box. D the piston-rods connected to the horizontal-rod G Y. *e e* are the straps, in their usual situation. *f* the end of the beam. H, H, the guide. Fig. 2, *i* is the end of the rod G (in fig. 1). H, H, is the guide, and *j* is a hard piece of wood (or iron) to form a solid base to the guide.

I am, Sir, yours, &c.

MASHDOUD MOHANDEZ.

Dec. 30, 1833.

MR. SAXTON'S LOCOMOTIVE-PULLEY.

Sir,—If any thing could justify the terms in which your correspondent, Mr. Adams, impugns Mr. Saxton's locomotive-pulley, it is the circumstance that he has had the manliness to put his name to his communication; and yet, both in justice to himself and to Mr. Saxton, he should have been quite certain that he perfectly understood the invention and its application, before he permitted himself to say of it, that "it is founded in ignorance of the principles of mechanics."

The model with which Mr. Adams' experimented appears to have been very imperfectly constructed, for he speaks of a weight of 135 ounces requiring 2 ounces to propel it on a common level railway, which makes the draught from friction to be 1 in 67, instead of 1 in 200. His experiments also do not appear to have been very carefully conducted, or perhaps they were vitiated by the excessive friction; for he says, that when his railway was made to rise 7 in 8, "he found it required 12 times the power of propulsion at that acclivity that would suffice upon level ground." Now this proportion depends upon another, that of the friction to the weight. If he had taken results found in actual practice for his data, he might have said, that the power required in such case was more than 20 times instead of 12 times greater; he has, therefore, understated the unfavourable view he has taken of the subject.

However, let those two points pass, and let us proceed to "the fundamental objection," and the fatal one too, if it were correct, which Mr. Adams advances against the principle of the invention. "The whole action," he says, "consists of nothing but friction;" and he illustrates this assertion by his experiments, by which it appears, that whatever power is employed to propel a carriage upon a level railway, 25 times that power is required to propel it upon Mr. Saxton's plan. Now it may be very true, that his experiments showed this proportion, for we are not informed what relation the diameters of the two pulleys bore to each other; but the inference from this is not, as Mr. Adams supposes it to be, that 25 times extra power is required, in order to overcome 25 times greater friction, but that there is a capacity in the machine to effect 25 times greater velocity, the propelling force travelling in each case at the same rate. This power is converted into velocity, a circumstance which he entirely overlooks, and not uselessly expended upon "a friction-machine," as he strangely supposes.* He of course must be aware that Mr. Saxton does not pretend, as do others, to generate the high velocity at which he aims (30 miles an hour), in a perpetual-motion fashion. Mr. Adams, therefore, should have shown, in disparagement of the invention, that the velocity is obtained in a more circuitous manner, and at an expense of a greater waste of power by friction or otherwise, than by any other known method; a task which he would have found very difficult to execute. In fact he is without

* It is not to be supposed that in this, any more than in any other mode of producing a great locomotive velocity (the resistance from friction being alone considered), that it is obtained, theoretically speaking, only by a great expenditure of power, for the time of performing a given distance is inversely as the velocity.

the necessary data: he must wait till Mr. J. I. Hawkins has furnished a report of the experiments made by him with such machinery as would be adopted in actual practice. I can, however, state that the friction peculiar to the apparatus is very inconsiderable, which indeed was to be anticipated from its extreme simplicity; and, as to the application of animal force for the effecting of such a high velocity as is contemplated, every one knows that it is at the slow walking pace adopted in this plan, that the maximum effort is produced. The immense and rapidly increasing waste of animal strength which takes place, as the rate of travelling is urged beyond 2½ miles an hour, is therefore avoided. There is nothing, however, in the scheme to prevent stationary steam-engines, with slow movements, being employed, instead of horses or oxen; and any engineer knows that, in this case also, a moderate velocity of the actual force is a very important circumstance in favour of its efficiency, and that the difference of effect between a fixed and locomotive steam-engine, the consumption of fuel being the same, is very great indeed.

If only mechanical considerations be allowed to have place, it may be safely said, confirmed as the opinion is by the result of the experiments that have been made, that a better scheme for locomotion has never been presented to the public; but if certain commercial and practical considerations be admitted, we then enter upon more debateable ground, and the present is not the time to argue the matter. Perhaps I may be disposed to allow that the plan is not so suitable for grand trunk communications, though it is proper to state that Mr. Hawkins, the civil engineer, is of a contrary opinion; but if it could be applied only to subordinate lines, and branch communications, it would fill up an important public desideratum, namely, a cheap description of railway, whose original outlay and current expenses should be commensurate to a second-rate traffic. For other still less important lines of intercourse, steam conveyances on common roads, would suffice. We should thus have a gradation, and a fitness and proportion of means to an end; an object which is too much lost sight of in this country, from our ambition to do things nobly and magnificently.

Can it be reasonably expected that any of the railways at present projected, if executed on the grand scale that is contemplated, will pay a proper interest on the capital expended, unless at the sacrifice of cheapness of conveyance, which, in a national point of view, is, equally with rapid communication, a principal object in the railway plan? What is to prevent the railway companies, even in the rare case of ample profits, unrestricted as they are in their amount, from making the passengers' fare the same as what the coach proprietors are accustomed to charge, for the superior ease and rate of travelling will always give them the monopoly? The public will be completely at their mercy, unless a wholesome competition should spring up by the introduction of steam coaches; and this may be expected to take place, if this species of conveyance can be brought into action at all, and if relieved, in a great degree, from those other charges unconnected with the mere cost of conveyance, which press so heavily on railway transit. In the Liverpool and Manchester railway these two classes of charges are nearly equal in amount. Now, if a scheme be proposed in which the last description of charges, that of mere locomotive expense, must be considerably less than by any other plan, either that of stage coaches, steam coaches, or rail-way locomotives (and there are other considerations besides the mechanical ones just adverted to which go to prove this point); and if the other description of charges connected with the road should not be greater than exists on the best turnpike roads (and the current expense of keeping such roads in repair, which is very great, as well as the original outlay, must be taken into consideration in establishing this point)—then it is obvious that such a scheme must be superior, in regard to economy, to every other that now exists. Such are the pretensions which are put forth in behalf of Mr. Saxton's plan; but besides, that it would require a pamphlet to substantiate them in detail, it is not as its advocate that I step forward on this occasion, but to justify it from the imputation of being "founded in ignorance of the principles of mechanics."

In regard to ascending hills I would just state, that in the case of such acclivities as would require the force

of traction to be one-eighth of the weight, the power employed would be about seven times greater than would be used on a level, the velocities being respectively 10 miles and 30 miles an hour; but such extreme cases need not occur.

I am, sir, yours, &c.

BENJ. CHEVERTON.

P. S.—Though the controversy on Mr. Badnall's undulating railway appears to be dropped for the present, I do not consider myself precluded, with your consent, Mr. Editor, from continuing the discussion with Kinclaven, on those points which were incidentally raised relative to atmospheric resistance at high velocities, the powers of an engine necessary to cope with it, and the ratio of such powers under different velocities. These are matters of curious inquiry, and quite independent of the merits of Mr. Badnall's scheme. Kinclaven is for flying off at a tangent, and is desirous of evading the discussion, by diverting my attention to "undulating railway questions;" but this is a stale manœuvre to elude the "grapple" which he himself provoked, and will not be permitted. It concerns his honour and candour, that he should either acknowledge that he was wholly in an error, as he has already done that he was so in part, or else condescend to argue the subject, and bring forward his own views and calculations. Instead of which, he wishes to creep out of the *melée*, and instead of combating me, he fights with my effigy—a mere man of straw, to whom he can impute any nonsense, and for the sole purpose, apparently, of relieving himself of a little banter.

ARCANA OF SCIENCE FOR 1834.

The present volume—the seventh—of our *only* scientific annual,* bears, in all its features, so close a resemblance to each and all of its elder brethren, that the same remarks which applied to them, will apply quite as well to the new-comer. We are sorry to record, that, amongst the "inventions and improvements" of the past year, there is not to be found any very notable "invention" of the worthy editor of the *Arcana*, for the "improvement" of his little periodical; so that the only consolation we have is the hope that it may be one of the most brilliant "new facts" of the coming twelvemonth. To the dignity of an annual register, in its present shape, the book is clearly not entitled, any more than a political annual would be, which should consist entirely of unconnected extracts from the newspapers, bound together (if bound it might be called), by a very flimsy packthread of "arrangement." In such a work we look for something resembling a regular building, rather than a mere heap of uncemented stones; but the "Arcana" is far more like the latter than the former.

After all—not to be too severe—it must be allowed that the volume contains a very considerable number of interesting articles, although, as usual, the editor's leaning towards zoology, gives an undue preponderance to that branch of science—an entertaining one enough, perhaps; but, certainly, not of so much importance as many of the other divisions which figure in the title-page. It *does* seem a little out-of-the-way to devote no less than *seventy-eight* pages to "natural history," in a work which can only afford *five* under the comprehensive head of "General Science." It would be much better, also, to omit the "Scientific Obituary" altogether, than to cram into a space of less than a page a most brief, incomplete, and unsatisfactory catalogue of a few of the distinguished scientific characters whose deaths have occurred in 1833.

Under the head "Mechanics," as usual, most of the articles are such as have previously appeared in our pages; and we are glad to perceive that the editor has been more punctilious than heretofore, in acknowledging the source from which he has derived his materials. This is a good sign, and we hope the example will be generally followed, although piracy has become so much a matter of course in the "literary world," that it would be idle to expect any very rapid or radical reform in this particu-

* Arcana of Science and Art; or, an Annual Register of Useful Inventions, Improvements, Discoveries, and New Facts, in Mechanics, Chemistry, Natural History, and Social Economy; abridged from the Transactions of Public Societies, and from the Scientific Journals, British and Foreign, of the past year. With 45 engravings. London: 1834. Limbird. 12mo. pp. 314.

lar.* It is rather singular, that while most of the articles relating to mechanical invention are extracted from English and American periodicals, the great majority of those on chemistry are taken from continental journals. Is this a true indication of the actual state of things? It may be so, although the effect partly arises, we have reason to think, from the overlooking, by the compiler of the "Arcana," of the most important recent experiments of our own native chemists. A piece of news is, apparently, in his opinion, quite the opposite to a joke; *i. e.* all the better for being *far-fetched.*

As it will not do to reprint, by a way of extract, either the description of Mr. Rutter's process for generating heat, or Messrs. Walker and Burges' report on Blackfriars-bridge, which form the most prominent features of the first division of the volume, we must be content to quote the very first article, which possesses the merit of *not* having already appeared in the Mech. Mag. It relates to an improvement in Ceylon, where, it may be recollected, Sir Wilmot Horton was some time ago busily engaged in introducing English turnpike-roads and stage-coaches. This improvement seems to be connected with his plans to effect these objects:—

"*Satin-wood Bridge in Ceylon.*—This bridge has recently been thrown over the Mahavillaganga river, at Peradenia, in Ceylon, the richest and most extensive of all the islands appertaining to British India. It was designed and set up under the superintendence of Lieutenant-Colonel Fraser, deputy-quartermaster-general of the forces in Ceylon; and, independently of its interest as a novelty in bridge-building, it must be regarded as a gratifying specimen of British skill in the improvement of our colonial possessions.

"The bridge consists of a single arch (principally of satin-wood) of 225 feet span, or half as wide again as the centre arch of London-bridge. The roadway is 20 feet wide, and its height above the river at low-water-mark about 67 feet. The arch is composed of 4 treble ribs, transversely distant from each other five feet from centre to centre. The sum of the depths of these ribs is 4 feet, which, with two intervals of 2 feet each, make the whole depth of the arch 8 feet.

"The beams of which the arch is built, are, with the exception of those next to the abutments, from 16 to 17 feet in length, and 12 inches thick. They abut against each other with an unbroken section, and are secured at the joints by the notched pieces which support the roadway—the latter being held in their position by means of cross-ties both below and above the arch, and immediately under the roadway. These cross-ties, which are also locked into them, serve to give stability and firmness to the whole structure.

"According to the original design, no material but timber has been admitted into the construction of the arch. The arch was commenced in the middle of July, 1832. The centering was struck on the 1st of October, and the roadway was completed before the 1st of January, 1833.

"Wooden bridges, generally, are condemned as being composed of a very perishable material; but, on the principle on which this is constructed, the different parts of the arch may be replaced as they decay. The American wedge-bridge is said to be exceedingly flexible; but this has been completely obviated in the bridge at Peradenia."—p. 1.

STEAM-CARRIAGES.

We were glad to observe, from the reception which Mr. Gurney's application met with the other day in Parliament, that the Legislature are disposed to give every encouragement to this valuable modern invention, and have no doubt that an end will speedily be put to the restrictions complained of; we mean the excessive tolls which were a few years ago introduced into several local turnpike-acts for the very purpose of prohibiting the introduction of this mode of conveyance, and which, by discouraging all undertakings of the sort, have retarded the progress of the invention, and materially tended to deprive Mr. Gurney and other steam-carriage projectors of the fair return which they were entitled to look for from their ingenuity, and the enormous capital which they had expended in following out an object by which there can be no question that the nation, as well as individuals, will ultimately be largely benefited.

Although not the inventor of "the steam-carriage," Mr. Gurney has certainly esta-

* We must except from this general censure our good friends of the "Perth (Swan River) Gazette," who, as far as we are aware, have never quoted from the Mechanics' Magazine without due acknowledgment.

blished his claim to the distinction of having first shown its practicability to any extent on common roads, and his method of construction has been adopted in many of the English carriages; but we must take the liberty of observing, that the honourable member for Greenock, Mr. Wallace, ought to have known better than to have described our Scotch steam-carriages built at Edinburgh, and at present plying on the Glasgow and Paisley road, as being *on Mr. Gurney's principle*. They are about as opposite as any two things intended to serve the same purpose can well be, and were constructed by Mr. Russell, the inventor, for the express purpose of avoiding the defects which were attachable to Mr. Gurney's and the other English steam-carriages. These defects are ably pointed out in an article, well known as the production of that gentleman, in the *Foreign Quarterly Review* of October, 1832; and we may state, with confidence, that the mechanical imperfections therein described have been completely obviated in the carriages which have been lately built under his immediate superintendence and directions, for the Steam-Carriage Company of Scotland, and that nothing farther remains to be done but what a little training and experience will speedily superinduce. That we may not be supposed to allude to alterations in mere matters of detail, although in these, and the general arrangements of the mechanism, many important changes have been effected, we may mention, that among the leading features of the machinery, which, we understand, are patented, there is a boiler (the point where all engineers know that the greatest difficulty has hitherto been experienced), which is constructed upon a new and most ingenious principle, by which the inventor, while he avoids the objectionable system of tubes and separate chambers, is enabled to form vessels of almost any magnitude, and capable of sustaining, with the most perfect safety, any given pressure, *without increasing the thickness and weight of the material of which the sides are composed*—a principle which will be invaluable in its application to the engines of steam-boats, ships' tanks, brewers' vats, and a variety of other economic purposes, as well as locomotive-engines; a cylinder, or steam-engine, also, of an entirely new form, and a spring, which we took occasion to describe in a previous article on this subject, by which, for the first time, the important end has been attained of perfectly suspending the whole machinery, so as to protect it from the derangement and injury which would be otherwise consequent on the jolts and agitation of a bad road.—*Caledonian Mercury*.

RECENT AMERICAN PATENTS.

(Selected from the Reports in the Franklin Journal, by Dr. Jones, the Superintendent of the Patent Office at Washington.)

A Frieze Window.—*William Woolley, New York*.—The patentee states, that he some years since invented the frieze window as a substitute for the dormar window, and that it has come into exclusive use in many of the best houses in New York. It receives its name from being inserted in the frieze under the cornice, and the present patent is taken for an improvement in the mode of fitting up, or finishing, such windows. For a house of ordinary size the opening in the frieze may be 3 feet 6 inches in length, by 22 inches in height. This is to be covered with an ornamental fret-work, which may be made of cast-iron; this, when painted white, will appear like an ornament to the frieze, while it will admit sufficient light through the frets, and conceal the sash behind it.

Saw for Cylindrical Work.—*Sumner King*.—The saw is to be a complete hoop, with teeth upon one of its edges. Its diameter must, of course, depend upon the curvature required in the stuff to be cut. The inside of the saw rests against friction-rollers, placed in a circle at equal distances apart, excepting at the point where the cutting is to be effected, a space being left there equal in width to that of the stuff to be cut. A band is to be placed around the saw, and over a driver by which it is to be turned; and this band is made to embrace the saw around a large portion of its circumference, by means of two friction-pulleys, which, however, leave it free at the cutting part. Two of the friction-rollers are to have a cant to incline the saw, to keep back on its bearing, which is against friction-rollers.

We believe the plan to be new, but are apprehensive that the stiffness in the cutting part will not be sufficient to cause the saw to work well without making it inconveniently thick.

Explosive Gas-Engine.—*Henry Rodgers*.—The patentee claims, as his invention, the "application of the power produced by the explosion of gunpowder, or any other explosive compound, to machinery in general, whether in the form described, or in any other that may suit better;" and he then informs us,

that he intends to apply the power more especially to locomotive-engines and carriages, to run upon common roads. As regards the machine it may be sufficient to observe, that it contains a piston within a cylinder, which is to be forced up by the explosion of gunpowder, ignited by means of a hammer striking upon percussion powder.

Putting out of the question the schemes for perpetual motion, we could not call to our recollection a patent more essentially deficient, both in form and substance, than the one before us. In the first place, the patent is taken for a naked principle, independently of any practical mode of applying it, which is not in itself patentable. In the next place, the idea of employing this principle has not the shadow of a claim to novelty; many essays have been made to apply the explosive force of gunpowder to the propelling of machinery, and after the expenditure of large sums of money, it has been abandoned as hopeless. As regards other explosive compounds, which are all embraced in the sweeping claims of the patentee, the records of the patent-offices might have admonished the present applicant of the futility of such a claim. Brown's gas-engine in England, and Morey's explosive engine in America, are familiar examples.

IMPROVED THRASHING-MACHINE.—*Daniel A. Webster.*—The rims, or heads, which form the ends of the cylinder, carry four fluted cylinders, extending from one to the other, having their axes on the peripheries of the heads, and the flutes straight, from one end to the other of the rollers. The concave segment is formed of small rollers or reeds extended across it, and corresponding in size with the flutes upon the beaten roller. There is to be a space of about half an inch between the flutes and the reeds on the concave, thus allowing room for the straw to pass: the numerous flexures of which, in its passage will, it is said, thrash or clean out the grain, whilst the motion of the rollers upon their axes, in a direction the reverse of that of the cylinders, will allow the latter to revolve under less obstruction than usual.

The part of the cylinder usually called the beaters, differs essentially from those used in any of the numerous thrashing-machines which have preceded it.

NOTES WORTH NOTICE.

"THE LAST link in the electric chain is as essential to the completeness of the communication as the first."

A Literary Curiosity.—The Rev. Mr. Gutzlaff's Chinese periodical, to which some allusion was made in a recent number of the Mechanics' Magazine, has now commenced its career, and the opening number has reached England. One of the editor's first difficulties seem to have been to find a Chinese equivalent for our term "Magazine;" and the title adopted, which may be translated "The Universal Magazine," looks, to unsophisticated eyes, rather lengthy—

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The work is written in the 日說 or fashionable modern style, and is calculated to impress on the minds of the natives of the 中國 a more exalted opinion of foreigners than they have hitherto entertained. One of the principal articles in the first number is a "Comparison of the History of the East and the West." It also contains an account of the islands of Java, Sumatra, &c., illustrated with a wood-cut map, exhibiting the European degrees of latitude and longitude. Mr. Gutzlaff possesses a happy facility in accommodating himself to Chinese ideas. His preface opens with a maxim from the native sage Confucius. It is to be hoped that his work will be followed by a host of others of the same class; indeed we do not despair of seeing some "Chinese Mechanics' Magazine" flourishing ere long in the very *stationary* dominions of his Celestial Majesty.

Captain Ross and his Crew.—The Committee appointed by the House of Commons to investigate the claims of Captain Ross to a reward from the nation for his exertions in the late North Polar expedition, have concluded their labours by recommending a grant of five thousand pounds; at the same time regretting that the spirited fitter out of the expedition, Felix Booth, Esq., will accept of no other compensation for the expense he incurred, about sixteen thousand pounds, than the well-earned applauses of his countrymen. It appears that the Admiralty, not content with allowing double pay to the officers and seamen engaged, have also provided for them permanently, by placing the latter in situations in the dock-yards or the navy, and by granting promotion to the former. Commander Ross is to be made a post-captain at the expiration of a twelvemonth; Mr. Thom, who, as well as the other officers, served without any prospect of pay, and ranked as third in command

of the expedition, has been made a purser in the royal navy; and Mr. M'Diarmid, the surgeon, has been presented with a surgeoncy on board one of his Majesty's ships. Thus all parties concerned appear to have had their services liberally considered by the Government, although, from the expedition being of an entirely private character, they could have, strictly speaking, no *claims* on the public.

Saxon Science in the Land o' Cakes.—Active preparations are already on foot in Edinburgh for the reception of the "British Association for the Advancement of Science," whose fourth annual congress is to take place in the Scottish capital in September next. It is not probable, however, that it will be so splendid an affair as the two last meetings at Oxford and Cambridge; since, as a Scottish periodical hints, the learned bodies of "Auld Reekie" do not possess the control over funds so extensive as those of the great English universities: it is proposed, notwithstanding, for the honour of Caledonian hospitality, to give at least *one* dinner to the southern horde, and leave the "pock-puddings" to their own discretion for the rest of their stay—except as regards food for the mind! The first meeting of the association, that at York, was held, as this is to be, in September, but those for 1832 and 1833 both took place in June.

Progress of Steam Navigation with India.—A steam voyage from India to England, by the Red Sea, seems at last to be *really* on the eve of taking place. The steamer Forbes has been engaged to start from Calcutta for Suez in the beginning of the present month, the Hugh Lindsay having been pronounced unfit for the purpose. The whole expense, except that of the coals, is to be borne by the Indian Government; while the Calcutta Steam Navigation Committee, will receive all the profits on passengers and all kinds of freight, except letters, the postage of which will be reserved by the Government. Should the voyage succeed, the steamer may be hired for two more trips on the same terms. The fund is still increasing by subscriptions from every quarter, but, unfortunately, symptoms of dissension begin to appear between the Bombay and Calcutta committees, in consequence, it may be supposed, of its having been determined that the start shall be taken from the latter port, instead of the former, which had all along looked for the distinction.

The New Smithfield at Islington.—The opposition to this concern has become so strong and so decided, that it is highly improbable the bill for enabling the proprietor to commence operations will find its way through Parliament. It is by no means unlikely, however, that the agitation of the question will induce the City to take some steps for the removal of the great cattle-market from the heart of the metropolis. The idea of attaching *abattoirs*, or slaughter-houses, to the new building, has been for some time abandoned.

The New South Wales Magazine.—The first number of this periodical has already reached England; it is crammed to the full with "local" matter, but betrays altogether what is too plainly the fact, that, although printed and published at Sydney, it is chiefly intended to find a sale in "the London market." Almost every article—nay, even the very matter—bears about it a sort of consciousness of its being "got up" to produce a striking effect in the minds of the English, rather than the colonial public, which takes away mightily from the interest of the affair. Amongst the contributors is a Dr. Lhotsky, a Russian emigrant, who, we perceive, is now endeavouring, after delivering a course of lectures on geology and mineralogy, to better his fortunes by setting on foot a "Mine-exploring Association," for bringing to light the mineral treasures of Australia. Literature is by no means so cheap in New Holland as at home, if we may judge from the price of this magazine, which, although of a consumptive thinness, is charged at half a-crown.

The Statistical Society.—Two meetings have been lately held for the establishment of a society for the collection and publication of statistical details; and a committee has been appointed to prepare the laws of the intended association. Such a society would undoubtedly be far from the least important, in its objects and the value of its labours, of the learned bodies of the metropolis, numerous as they have become of late years. The plan does not lack influential supporters, if we may judge from the circumstance of the Marquis of Lansdown's taking the chair at the preliminary meeting, and addresses being delivered on the same occasion by Messrs. Goulburn, Spring Rice, &c. &c., as well as by the staunchest supporter, if not the originator, of the society, Dr. Jones, the new Professor of Political Economy at King's College. F. H.

"The description given in the Mechanics' Magazine, No. 554, of the Birmingham Town-hall, requires several corrections. In the first place, Mr. Harris is not the architect; he was merely the publisher of a beautiful view of the building—Messrs. Hansom and Welch were the architects; and they have been no further concerned at Liverpool than in the superintendence of a church. The fluted columns were not worked by machinery, as the description states—the whole was done by hand, except the sawing, which was done by an ingenious machine, the invention of Mr. Hansom, one of the architects—whose design, in fact, the whole building is. The columns, in the view, are only five diameters in height, whereas they ought to have been ten. Another defect is, that the basement is shown of regular masonry, whereas it is formed of the roughest blocks, called rough rustic."—Geo. Glover. 17, Gerrard-street, Soho, 29th April, 1834.—We understand that some misunderstandings have unfortunately arisen between the committee for superintending the erection of the Town-hall and the contractors. The contract has, it is said, been broken, and the committee have, for some time past, had workmen of their own employed on the building, which cannot, however, be now completed within the time contemplated. The estimated expense will also be greatly exceeded.

A second number of the "Library of Popular Instruction" has been left at our office, with a very pretty enamelled card, on which is engraved the name of "Dr. J. P. Litchfield." We gather from this that we were wrong, in hinting that the words "Edited by Dr. J. P. Litchfield" might cover a mere fiction of trade. What he is doctor of, however, we have yet to learn; and it must be confessed, that he takes rather a questionable method of putting *forward* his academical pretensions. Is he of Oxford, or Cambridge, or Edinburgh, or St. Andrews, or cannie Aberdeen? Is he LL.D., or D.C.L., or M.D., or Mus. D., or only (what his Library deserves to be) D———D.?

Communications received from φ. μ.—Mr. Holmes—Northampton—Mr. Bayley—R. M. A.—A Seeker—Mr. Baddeley—Mr. Landale—A Semi-Snob.

Erratum.

Page 61, in the article by φ. μ., for "Bannoscope" read "Baunoscope"—the principal root of the name being βαυνος, a furnace.

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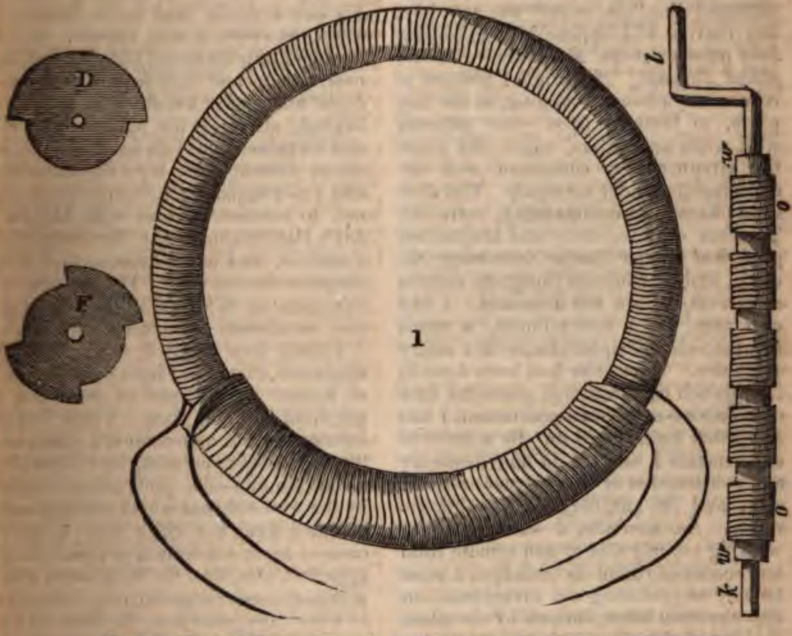
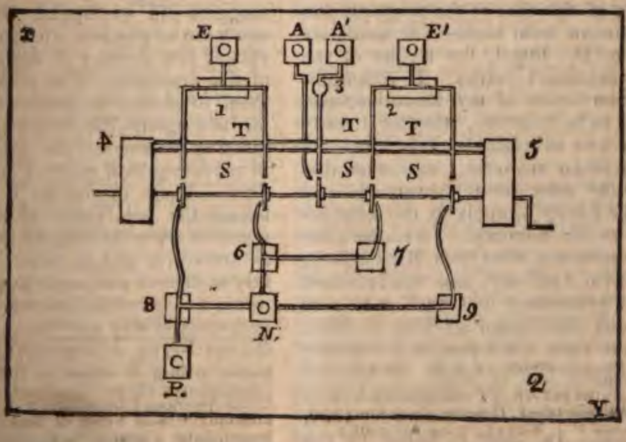
MAGNETO-ELECTRIC RING.





DESCRIPTION OF A MAGNETO-ELECTRIC RING, EQUAL IN POWER TO THE LARGEST GALVANIC BATTERIES.

Sir,—In my communication, which you have done me the honour to insert in No. 556, page 6, I promised to send some of the heads of a paper, drawn up for Prof. Jameson's Journal of April last, in case it should have been too late for that quarter's number. I have since been informed that the paper was too late, but that it will appear in the coming July number of the *Edinburgh Philosophical Journal*. Meantime I proceed to redeem my promise, begging, in the first place, to trespass upon your patience with a few particulars, which the peculiar circumstances connected with my experiments render necessary. The data in my hands, on commencing, were the Treatises on Electricity and Magnetism published by the Useful Knowledge Society, and a common magneto-electric apparatus, with a bar armature. I had also seen, for a few minutes, a small magneto-electric apparatus, with a rotary armature. What else had been done in this branch of electricity, since the date of the above-mentioned production, I was altogether uninformed of. By a series of experiments I was led to the discovery and construction of the magneto-electric ring, and its auxiliary the galvanic reverser. As, however, I was aware that working entirely alone, and remote from any source of recent information, I must be only re-producing old inventions—an apprehension strengthened by the plain leading of the data to the consequences I had drawn from them—I immediately wrote to Dr. Roget, the author of the above-mentioned tracts. I communicated the heads of my invention, and begged to be informed, whether it really was as new as original. I had not the honour of an answer. I concluded that my letter must have miscarried, and took the liberty to apply in the next instance to Mr. Faraday. I had the pleasure to receive a letter from Mr. Faraday, dated 14th April last, and was informed by that gentleman that such a ring as mine was constructed by him in 1831, and that from it was produced the very first magneto-electric spark. He referred me to a paper on the subject by him in the *Philosophical Transactions* for 1832, *page 131. In order to* follow up the *reference, I was obliged* to write to a friend eighty miles off. He had the kindness, assisted by another, to transcribe the paper in question, and I this day (May 10th) received the manuscript. On a perusal of Mr. Faraday's paper I find that he has, indeed, anticipated me in the discovery of the principle of the construction of the ring, and has followed out most of the principal ramifications in such a masterly style as his name would lead us to expect. I think, however, it will appear, that the practical importance of the ring has been overlooked, and not fully developed—other and more dazzling results, seen beyond, attracted the philosopher's eye, and he passed on. I do not, therefore, sir, mean, although all my own deductions and experiments have been strictly original, to interfere further with Mr. Faraday's clear claim to the discovery of the principle, and to the construction of the magneto-electric ring. The practical development of its almost unlimited powers may be allowed to be mine.

I shall now proceed to describe the apparatus, of which I have prefixed a sort of figure. The course of reasoning in my mind took this turn. I saw that the development of the magnet's electricity, by the rotary apparatus, had arrived at its maximum—the limit being imposed by the unwieldiness which the apparatus assumed when the effect was to be increased beyond a certain degree. It was apparent, also, that the maximum effects produced were comparatively feeble, and in some cases dubious. Permanent steel magnets did not appear essential, because the magnetism, which immediately excites the electrity of the coils, is that of the armature. The remedy seemed, then, to consist in dispensing with the mediate agents, the steel magnets, in increasing the size of the armature, and in rendering both magnet and armature fixed. These conditions I effected by taking the iron ring, by making one segment serve as magnet and the other as armature, and by transferring the rotary motion to a separate auxiliary apparatus, the galvanic reverser. The magneto-electric ring may be constructed as follows:—The dimensions I state are those which I consider the maximum, consistently with convenience. It is scarcely worth while to stop short of the maximum, when magnificent results may be attained by a comparatively

small increase of expense and trouble. A ring of iron, fagotted and welded, is to be procured. It may be 4 feet in diameter of the periphery, and 4 inches in diameter of the armatures. One segment ($\frac{3}{4}$) is to be mounted with coils of copper wire (No. 13) sixfold, each fold, or thickness of wire, being carefully insulated from the iron, or from each other; and, for the convenience of experiment, the six thicknesses may be joined by pairs into three systems, by soldering the ends of each pair of thicknesses to two thick wires, as one pair of poles. The other segment ($\frac{1}{4}$) must be mounted with nine or ten thicknesses of similar wire laid on in a similar direction. The ends of those are all to be collected into one common pair of poles, by soldering them to two pieces of very thick wire. Especial care must also be taken to insulate the systems of one segment from those of the other.

Fig. 1 represents a magneto-electric ring. The one I constructed weighed only $10\frac{1}{2}$ lb. of iron, and had about 70 yards of wire on the two segments; and, when excited by a battery of one pair, of 1 square foot surface of zinc opposed to one similar surface of copper, the spark it produced was far superior in brilliancy and intensity to that produced by the rotary apparatus, which I mentioned in the outset as having seen.

The construction of the galvanic reverser is as follows:—X Y is a solid block of mahogany, about $1\frac{1}{2}$ inch thick, and 14 inches square. The view is downward, and the rectangles 1, 2, 3, 4, 5, 6, 7, 8, 9, represent the heads of uprights firmly set into the block. 4 and 5 stand above the mahogany to the height of 6 inches, and all the rest to that of 5 inches. The mark at 3 stands for the head of a glass tube, or rod, 1 inch in diameter. It also is firmly set into the mahogany, and rises to the height of 5 inches. On the heads of the uprights, 1 and 2, are fixed T shaped pieces of strong copper wire. The middle piece of the wire has a screw cut in it, on which screws a small rectangular block of varnished wood, and it is screwed so far that the wire enters a circular cavity bored in it, as a cup for mercury. This I find the most convenient form for the connecting-*cups of mercury*, being in*finitely superior in practical* convenience to the mode of making the wire enter the bottom of the cup. The branches of the wire have pieces of brass soldered to them, which proceed in parallel directions. The glass pillar at 3 has a similar combination fastened on its top, and another sort fastened lower down on its side.

S, S, S, is an axis, to be hereafter described, carrying on it five circular copper discs, which are kept in their places by five brass screw-nuts, each working in as many separate and insulated pieces of brass tube, on which the copper discs themselves are also made to screw. T, T, T, is a stout rod, or tube of glass, fixed across from the upright 4 to 5 Across this tube all the brass springs come, until they touch and press lightly upon the limbs of the disc; viz. all but one, which one proceeds under the tube, and presses on the face of the disc. The tube is intended to preserve the elasticity of the springs by meeting them in their recoil, and every spring is buffed on the under side. It is obvious why the rod must be glass. On the other side of the axis the upright 6 supports a combination similar to those already described; but another upright 7 is necessary to support the branch coming from the former. 8 and 9 are in quite the same condition. The branch from 8 is bent down, so as to pass clear under the mercurial cup of 6. The brass springs, forming these latter, are all made to press on the faces of the four outer discs. The four outer discs are of the shape of fig. D, and the middle are like F. Each disc is nearly $\frac{1}{8}$th of an inch thick. The axis is seen separately at fig. 3. K, L, is a metal wire about $\frac{1}{4}$th of an inch in diameter. A piece of baked wood, $w\ w'$, is cemented on it, and turned in a lathe until it is about $\frac{5}{8}$th of an inch thick. It is then well varnished, and five pieces of brass tube, o, o, &c., each $\frac{3}{8}$ths of an inch long, and screwed on the outside, are cemented firmly on, at intervals of $\frac{1}{4}$th of an inch. On each is screwed a disc and a nut, and the axis is put into its place in 4 and 5. The discs are then so adjusted, that the right-hand branches of E and E′ shall be taken up and let go simultaneously, and also the left-hand branches of E and E′ in the same manner. The central disc is to be so adjusted, that it shall take up or let go its

right-hand spring always at the same moment with the release or engagement of the other pair. All the remaining springs press constantly on the faces of their proper discs. The apparatus so constructed and adjusted is to be interposed between the ring and the battery. The cups are to be all filled with mercury, and the points of contact of the springs and discs to be well amalgamated. The poles of the galvanic battery are to be inserted into the cups P and N, those of the electro-magnetic segment of the ring into E and E′, and those of the magneto-electric segment into A and A′. Then, by turning the axis, a continual succession of sparks of the galvanic fluid will pass, alternating in contrary directions through the systems of the electro-magnetic segment, and at each reversal a disjunction of the poles of the magneto-electro system will be effected, and the electricity developed. A multiplying-wheel may be adapted to the axis, or the discs may be serrated on their limbs.

This apparatus, though complicated in appearance, will be found exceedingly simple and certain in operation, when once a proper adjustment of the parts have been effected. In the reverser I first constructed I employed eight mercurial surfaces, and eight discs working in them; but this plan, though very much more simple in appearance, I was obliged to abandon, on account of the precarious nature of the adjustment it allowed of. From the performance of the ring I have constructed, the magnitude and brilliancy of the spark it produces under feeble excitement, I judge that such a ring as I describe would, when properly excited, produce effects equal to those of the largest galvanic batteries. And when it is recollected, that the same reverser and galvanic battery can work two, five, or ten such rings, with the same facility as one, I think I shall be held justified in calling the powers of the ring all but infinite, and in pointing out this as the proper direction, in which the efforts of experimental inquiries in this field should be turned.

I am, sir,
Your obedient servant,

Φ. μ.

CALCULATION OF THE TOTAL NUM
PERSONS EMPLOYED IN COTTON
IN ENGLAND. BY MR. SAMUEL
WAY, ACCOUNTANT, MANCHESTE

[This calculation is founded on returns
the owners of cotton mills in Lancashir
shire, and Cheshire, to a circular form c
issued by Mr. Cowell, one of the Fact
missioners, who investigated that distric
returns that have been received," says
ell (Explanatory Preface), " amounting
300 from cotton factories and 50 from
tories, were placed in the hands of Mr
Stanway, an eminent accountant in Ma
This gentleman had previously lent his
in drawing up the forms; and his profes
quaintance with the system of book-ke
registration in use in cotton and silk w
enabling him to test the accuracy of the
various ways peculiarly fitted him for th
tabling them. He has approved of one
and fifty-one returns from cotton mills
both accurate and complete, and of sev
as being accurate as far as the replies ext
out being complete in all particulars;
turns from four night mills. The table
submitted, have been compiled from the
and the remaining returns have not been
in their construction. The task of calcul
tables has occupied Mr. Stanway conti
six months; he has made every calcula
self, and has checked and compared it
original documents after it was execute
nature to the tables conveys his attestati
to the fidelity with which he has made t
lation, and to the accuracy of it. I am r
for the principles on which the forms
were constructed—and solely answerab
construction of the tables, as far as th
ment and classification of the results is c
and for sanctioning the principles on w
Stanway's calculations have been made
averages deduced. This task, however
have been incapable of performing, had
a less able and zealous assistant than th
man, whose suggestions, in fact, hav
guided me throughout. He is fully entit
larger part of whatever merit the tabl
found to possess."]

The subsequent calculation does
at fixing the whole number of opera
pendent upon the cotton trade for
ence, but only of that part of the
body which earns a livelihood in co
tories *moved by power*, and is emp
carrying on the preparing, spinning,
and accessary mechanical departmen
the walls of them.

It does not comprehend hand-loom
printers, bleachers, dyers, cotton-th
makers (an enormous and growin
of the cotton manufacture), and ma
branches of manufacture either o
immediately dependent upon, the sp
cotton by power. It comprehends t
ratives alone who habitually work i
factories. It shows their body to
212,800 persons, and to earn ann
enormous sum of 5,777,434*l*. 14*s*. 1

CALCULATION.

The total quantity of cotton co

the spinning of yarn in Great Britain in 1832, as stated in Burn's "Commercial Glance," was 277,260,490 lbs., and of this quantity 27,327,120 lbs. was consumed in Scotland, leaving for the consumption of England 249,933,370 lbs.*

The net loss of cotton in spinning is estimated variously by different individuals, In the calculations of Mr. Kennedy, made use of by him in a paper published in the "Transactions of the Manchester Literary and Philosophical Society," it is taken at 1½ oz. per lb.; whilst Montgomery, in his "Theory and Practice of Cotton Spinning," computes it at 1⅝ oz., and Burn at 1¾ oz.; but as the amount taken by Mr. Kennedy is that which appears to be generally considered correct, it is adopted in these calculations.

If, then, from the quantity of cotton given above we deduct 1½ oz. per lb., or 23,431,253 lbs., we shall have the total weight of yarn produced 226,502,117 lbs.

The average number of hanks in each pound of yarn is considered, by apparently a majority of persons conversant with the subject, to be 40. Montgomery takes the average counts spun in Great Britain at 50*s*., which, taking into account the finer average numbers spun in Scotland than in England, would fix the counts nearly as above stated.

The returns made to the Lancashire forms of inquiry, as given in the previous tables, show an average of finer counts than 40*s*.; but as the returns were better made from the fine mills than from the coarse, and from Manchester, where the finer yarn is spun, than from the country, it is evident that lower numbers ought to be taken than those shown in the returns; and as the general opinion appears to be in favour of 40*s*. this average is adopted.

Three mills, in different situations, and of average capabilities,† made a return of the quantity produced by them in the month ending the 4th May, 1833; and as the average counts of the whole were 39·98 hanks to the lb., and as they also give the number of hands employed in spinning during that month, and the duration of their labour, they furnished data from which may be easily calculated the total number employed in factories in England in preparing and spinning cotton.

In the mill of the first, 344 persons in the spinning department, working 276 hours, produced

18,000 lbs. of 30*s*. to 32*s*.
18,000 lbs. of 38*s*. to 42*s*.
2,400 lbs. of 150*s*. to 170*s*.

In the second mill, 245 hands, working 270 hours, produced

1,795 lbs. of 12*s*.
4,285 lbs. of 22*s*.
33,838 lbs. of 40*s*.

And in the third, 110 hands, working 286 hours, produced

16,700 lbs. of 40*s*.

The average counts of the three being, as before stated, 39,98, and the produce 95,018 lbs.

The total number of hours worked will, therefore be $\overline{344 \times 276} + \overline{245 \times 270} + \overline{110 \times 286} = 192,554$; and the produce of each person per hour $\frac{95,018}{192,554} = \cdot 49,346$lbs.

The usual estimate of 300 working days per annum of 11½ hours each, or 69 hours per week, would give $.49,346 \times 11.5 \times 300 = 1,702,437$ lbs., the produce of each person per annum, and $\frac{226,502,117}{1,702,437} = 133,045$ the number of persons employed in the preparation and spinning of cotton in England.

On an examination of Supplement (Z.) it will be seen that in the 67,819 persons, of whom returns were made to the Commission, there were 43,401 engaged in preparing and spinning cotton, 23,920 in the weaving department, and 1,498 as engineers, mechanics, roller-coverers, &c.

If, then, the same proportions are taken as existing in the total number of cotton-workers which are found in the returns made to the Lancashire forms of inquiry, the number of persons engaged in the manufacture of cotton cloth in factories will be 75,055, and of those employed as engineers, &c., 4,700; making with the 133,045 in the spinning department a general total of 212,800 persons engaged in cotton factories.

Which total number of 212,800 persons may be divided and distributed, by adopting the proportions given in the returns made to the Lancashire forms of inquiry, so as to show the probable number of persons employed in each of the eight branches or departments of cotton-working, and the aggregate amount of their net earnings per month.

* I refer to general opinion at Liverpool and Manchester for the authority due to Burn's "Commercial Glance."

† It is perhaps hardly necessary to point out, after what I have said in my preface to these tables, that this calculation depends very much upon the three mills being of "average capabilities."—J. W. C.

Employed in	Adults.		Children under Eighteen Years of Age.						Proportion whose Age and Sex are uncertain from a deficiency in the Returns.	Total Number employed.	Aggregate Amount of Monthly Net Earnings.
			Males.			Females.					
	Males.	Females.	In the direct employ of Master.	In the direct employ of Operative.	Employer uncertain.	In the direct employ of Master.	In the direct employ of Operative.	Employer uncertain.			
Cleaning & spreading cotton......	1 330	2,319	951	3	31	345	6	13	....	4.998	8,631 19 6
Carding............	10 361	15 062	4.983	461	78	8,099	458	163	819	40,484	75.276 10 0
Mule spinning......	22,727	5 196	3 038	23,634	257	1.255	8,663	82	364	65,216	139.664 17 9
Throstle spinning ..	793	3 000	1,409	25	100	2.203	9	160	......	7 709	11.615 10 1
Reeling............	722	11.208	182	25	......	2.306	76	119	......	14.6 8	22 817 8 4
Weaving	20,410	28,566	4,581	2,582	204	12,109	4,261	119	2,193	75,055	168.663 16 3
Roller covering	261	389	19	3	......	31	22	......	......	725	1,764 18 5
As Engineers, Mechanics, &c.	3,759	34	151	9	19	3	....	......	......	3,975	15,987 0 9
	60,393	65,774	15,314	26,742	689	26,351	13,505	656	3,376	212,800	444,384 1 1

In Supplement (D.) is given the proportionate number of children, male and female, employed in factories, between fourteen and eighteen years of age, and below fourteen; it is therefore easy to ascertain the probable number of children under fourteen.

It there appears that the boys under fourteen are to the boys between fourteen and eighteen as 12.21 to 8.95, and the girls as 9.46 to 10.67; if, therefore, these proportions are applied to the 42,745 males and 40,512 females under eighteen, above given, we shall have—

Under 14	24,655	Males.
——	19,038	Females.
Between 14 and 18	11,080	Males.
——	21,474	Females.
	83,474	

If the school returns be then referred to, it will be seen that the proportions are there given of children working in factories of all the ages under fourteen: and it is therefore possible to calculate, with a considerable degree of accuracy, the number of children of each age.

In 5,400 males working in factories under fourteen, it will be seen that there are

7	males of 5	years of age, and under	6
19	.. 6	.. .. ..	7
64	.. 7	.. .. ..	8
180	.. 8	.. .. ..	9
657	.. 9	.. .. ..	10
1,089	.. 10	.. .. ..	11
1,141	.. 11	.. .. ..	12
1,147	.. 12	.. .. ..	13
1,096	.. 13	.. .. ..	14
5,400			

In 5,001 females working in factories under fourteen, it will be seen that there are

6	females of 6	years of age, and under	7
77	.. 7	.. .. ..	8
183	.. 8	.. .. ..	9
496	.. 9	.. .. ..	10
905	.. 10	.. .. ..	11
1,007	.. 11	.. .. ..	12
1,218	.. 12	.. .. ..	13
1,109	.. 13	.. .. ..	14
5,001			

Adopting these proportions there will be,

In the 24,665 boys under fourteen, working in cotton factories,

32		of 5 years of age, and under	6	
87		.. 6	7	
292		.. 7	8	
822		.. 8	9	
3,001		.. 9	10	
	4,234			
4,974		.. 10	11	
5,212		.. 11	12	
5,239		.. 12	13	
5,006		.. 13	14	
	20,431			
	24,665			

In the 19,038 girls under fourteen, working in cotton factories,

23		of 6 years of age, and under	7
293		.. 7	8
697		.. 8	9
1,888		.. 9	10
	2,901		
3,445		.. 10	11
3,833		.. 11	12
4,637		.. 12	13
4,222		.. 13	14
	16,137		
	19,038		

And in reference to the average earnings of the children of both sexes in cotton factories, as ascertained by the Commissioners in their personal inquiries at the Sunday schools in Manchester and Stockport, and given in the first report of the Commission (D. 1, page 88), taking the children under nine years of age at the lowest average rate, it will be seen that the following will be the totals of their net earnings per month:—

4,234 boys earning at the rate of	30.11*d*. per week,	£2,124	15	3
4,974	37.85 ..	3,137	15	3½
5,212	47.84 ..	4,155	14	0¼
5,239	52 57 ..	4,590	4	8¾
5,006	64.39 ..	5,372	5	5¼
24,665		£19,380	14	8¾
2,901 girls	34.41*d*. ..	£1,663	14	5½
3,445	41.41 ..	2,377	12	5¾
3,833	45.96 ..	2,936	1	6½
4,637	54.88 ..	4,241	6	2¼
4,222	68.86 ..	4,872	19	10¼
19,038		£16,091	14	6¼

From which it will appear that the net earnings of the above children under thirteen will be 25,227*l*. 3*s*. 11½*d*. per month; but as the amount of net earnings per week was given by the children for a full week, the above amount is to be taken as for twenty-four working days. The net earnings per annum of 300 working days will be 315,339*l*. 19*s*. 5¾*d*.

ADDENDUM.

And in like manner the net earnings of the total number of children under fourteen years of age, consisting of 24,665 boys and 19,038 girls, and amounting to 35,472*l*. 9*s*. 3*d*. per month, will be 443,405*l*. 15*s*. 7*d*. per annum.

Upon this calculation there exists a check in the returns made by the masters of the net earnings of children under fourteen, and a summary of which will be found in Supplement C., from which it will appear that their average net earnings in the month ending 4th May, 1833, were 46.35 pence per week, which being considered as the earnings of an average week,* will give an amount per annum of 438,887*l*. 7*s*. 6*d*.

The total net earning per annum of the whole estimated number of 212,800 persons will be 5,777,434*l*. 14*s*. 1d.

And since the proprietors of the mills included in the three lists previously given, employing 67,819 hands, as shown in Supplement Z., employ also 183 persons in the counting-houses and 1,147 in the warehouses (within the mills), adopting these proportions, there will be employed, with reference to the total number of 212,800 persons engaged in factories, an additional number of 574 clerks and 3,599 warehouse hands.

SAM. STANWAY.

* *By "average week" is meant one of a month* which contains an average number of holidays, and one which therefore has not to be taken into account as containing six days out of 300 working days, but one fifty-second part of a year.

A child, on being asked at the Sunday schools, personally, by the Commissioners and their clerks, the amount of its earnings per week, replied, doubtless, for a full week, and this has therefore to be calculated as six three-hundredths of the year;—whilst the returns of the masters embrace a period of the year which contains a proportion of the holidays (as near as can be imagined an average portion), and is to be taken as one week of the fifty-two, or as six three hundred and twelfths of the year.

Fig. 1.

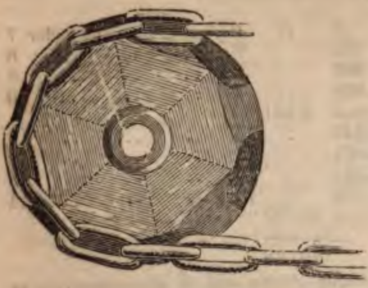
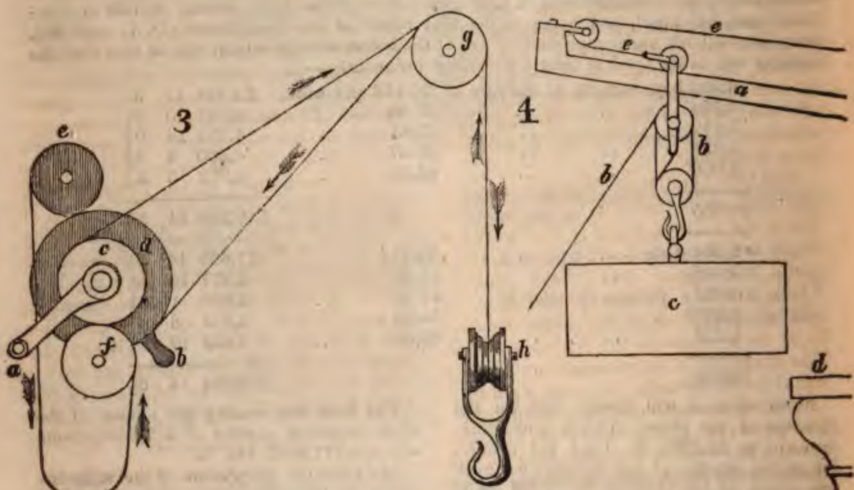


Fig. 2.



DIFFERENTIAL CRANE.

Dear Sir,—In No. 556 of the Mechanics' Magazine, $\phi. \mu.$ has given a new method of applying the *differential principle* to cranes, which is certainly an improvement on the old plan. But as it is in general easier to get two casts off one wheel, than to get two wheels the one with a tooth more than the other has, $\phi. \mu.$ ought rather to have made a difference in the diameters of his barrels, and then, if the top pulley-frame had been hung by a sling, the ropes would always have kept in a plane, passing through the middle of the grooves of the pulleys. In all the differential cranes that I know any thing at all about, the very great length of the barrel or barrels, and the immensity of chain required, form great objections; these objections are obviated, and one or two advantages besides are obtained in the following plan, the most material parts of which I have had in my "mind's eye" for some time now.

My first idea was to have a pitched chain, worked by pitched pulleys, and let its ends hang loose and fold into a box under the pulleys; but this would require as long a chain as any of the other ways, unless I had thought of some method (with the one pulley under the other) similar to $\phi. \mu.$'s, and then I could have connected the ends of the chain.

The want of flexibility (except in one direction) of a pitched chain is a great objection in particular cases. Lately, at the NEW SLIP DOCKS, near Glasgow, I saw a common chain worked like a pitched, by shaping the groove in the pulley or barrel that wrought it so as to receive the chain alternately on the flat and edge of its links, as shown in fig. 1. As the pitch of the links will wear longer, I think it would be an advantage to have the barrel made so that its pitch can be easily altered. If the pulley were divided into sectors, as shown by the dotted lines in fig. 1, and each sector fitted upon straight and parallel slips, cast in radial directions on a round plate that was firmly keyed upon the crane-shaft, then its pitch might be altered. The edge-section, fig. 2, shows the different parts. A common chain, and two pulleys of this sort, are to be used in the crane which is represented in fig. 3, and now to be described.

The two handles of the crane, *a* and *b*, are fixed upon the ends of the shaft on which the pulleys, *c* and *d*, that work the chain are fixed, and the rollers *e* and *f* guide the chain over these pulleys. There are two pulleys placed side by side at *g*, and set at the same distance from each other as the barrels *c* and *d*. The diameter of the *moveable* pulley *h* is equal to the distance that the *fixed* pulleys at *g* are placed from each other. The pulleys at *g*, and the rollers at *e* and *f*, must have grooves round them for the chain to lie into, like the pulley at *n*. The arrows mark out the chain, and show its direction when the weight is rising. As the chain passes down on one side of the pulley *h*, and up on the other side—the arrows above it are drawn in contrary directions. By having one or more additional barrels of different diameters fixed on the same shaft, the power of the crane can easily be altered, by shifting the chain to a different barrel, or set of barrels. If the crane had two jibs, the loose part of the chain that hangs under the barrels might be passed over another set of pulleys like those at *g*. In this way, one jib would be ready to take a lift as soon as the weight was hoisted by the other jib. The loose end, it is evident, may be applied in many other ways; if it is not used it must have a box to receive it under the barrels. By having the chain endless, a very short one answers the purpose. In cranes having a moveable jib, the weight would be entirely taken off the side-frame, if the part at the bottom of the upright stem, on which the friction-rollers work, were bevelled so much as to be perpendicular to a line passing down the centre of the jib. The chain has an *even* number of links.

My father was building a church, a number of years ago, and found considerable difficulty in getting large stones into the right place after they were hoisted, especially if projections below kept them from being hauled up close by the wall. I advised him to try an apparatus of which fig. 4 is a sketch, which answered perfectly; and in this part of the country the thing is now in general use. The broad needle *a* inclines upwards to the point, and is fixed above the building in the ordinary way; *b b* are the blocks and tackle hanging from it, and *c* is a stone to put on the top of the wall or cornice *d*. When the stone is hoisted as high as shown, it is let above its place by slacking the rope *e e*, which keeps the roller on which the blocks hang at any place on the needle. This roller has a flange at each end. When the stone is taken off, the blocks are drawn back by means of the rope *e e* to the right distance off the wall.

I am, yours, &c.

JAMES WHITELAW.

THE STEAM-ENGINE, THE COTTON-SPINNERS BEST FRIEND.

(From Mr. Toffnell's Report to Central Board of Factory Commissioners.)

Of all the common prejudices that exist with respect to factory labour, there is none more unfounded than that which ascribes to it excessive tedium and irksomeness above other occupations, owing to its being carried on in conjunction with the "unceasing motion of the steam-engine." In an establishment for spinning or weaving cotton all the hard work is performed by the steam-engine, which leaves for the attendant no manual labour at all, and literally nothing to do in general, but at intervals to perform some delicate operation, such as joining the threads that break, taking the cops off the spindles, &c. And it is so far from being

true that the work in a factory is incessant, because the motion of a steam-engine is incessant, that the fact is, that the labour is not incessant on that very account, because it is performed in conjunction with the steam-engine. Of all manufacturing employments, those are by far the most irksome and incessant in which steam engines are not employed; and the way to prevent an employment being incessant is to introduce a steam-engine into it. And these remarks, strange as it may appear, apply peculiarly to the labour of children in cotton factories. Three-fourths of the children so employed are engaged in piecing at the mules, which, when they have receded a foot and a half or two feet from the frame, leave nothing to be done,—not even attention is required, either from spinner or piecer, but both stand idle for a time, which, if the spinning is fine, lasts in general three-fourths of a minute or more. Consequently, in these establishments, if a child remains during twelve hours a day, for nine hours he performs no actual labour.* A spinner told me that during these intervals he had read through several books. The scavengers, who have been said to be "constantly in a state of grief, always in terror, and every moment they have to spare stretched all their length upon the floor in a state of perspiration,"† I have seen idle for four minutes at a time, and certainly could not find that they ever displayed any symptoms of the condition described in this extract from the Report of the Factory Committee.

If we wish to discover occupations which are really laborious, irksome, and incessant, we must go to those trades in which not only no steam-engine, but no machinery whatever, is used. The employment of milliners' girls is one of this description; they are engaged in it for a far longer period of time than the factory children; and I have it in evidence from medical gentlemen (*page* 120, *First Report*), that their health is more seriously affected by it than that of persons in factories. Surely bending over a needle sixteen hours a day cannot be deemed otherwise than laborious, irksome, and incessant in the highest degree. But the case of the pin-headers is the most glaring instance of the absurdity of the principle that sets a brand on those trades alone in which steam-engines are employed. The unhappy children engaged in this business, who are of a far tenderer age than any in factories (as I have seen them working at it before they have reached their sixth year), have to sit twelve hours daily at a table, with their bodies continually bent in the form of the letter C, their eyes intently fixed upon the pin-heads, and both hands and feet in perpetual motion.

At Derby there is a magnificent establishment for making bobbin-net, in which the whole of the machinery is moved by a steam-engine. The same machines are used at Nottingham, with the difference that they are there mostly worked by hand, and consequently the labour is infinitely heavier. In the Derby factory the labour required is so slight and discontinuous, and the machine performs its work with such admirable precision, that many of the workmen were literally at sleep in their places when I visited the establishment; yet they are included in the Ten Hour Bill, while their Nottingham brethren are omitted. The master of the establishment complained of the serious loss he should sustain by the operation of the bill, and asked me what justice there was in subjecting his business to it, in which the labour of the workmen was evidently so light, while the hard-worked operatives in the factories of his Nottingham rivals were left untouched? I could not answer his question.

The most irksome employment connected with cotton-spinning is "picking" cotton for fine work, an operation which is generally performed by the youngest children in the following way:—A fleece of cotton is hung up before the window, and the child standing constantly in the same place, with its head about six inches from the fleece, picks out the particles of dust that are lodged in it. The wearisomeness of this occupation must be, beyond all comparison, greater than that of the piecers or scavengers, as the child cannot stir from its place, but must keep perpetually looking at a bit of cotton; but it is not assisted by the steam-engine, consequently it may be worked twenty-four hours, or any number of hours, without intermission, for any thing Lord Ashley's Bill says to the contrary. In the coarse factories this work is done by the steam-engine, and therefore the child who attends the operation has not a tenth part of the labour to perform which it otherwise would have. Here, then, it is protected by a factory bill.

Occupations which are assisted by steam-engines require for the most part a higher species of labour than those which are not; the labour of the head is then partially substituted for the labour of the muscles; in fact, it becomes in some measure skilled labour, and like all skilled labour is paid highly, as the tables of wages I have given prove. In no other way can I account for

* A piecer, however, generally attends two mules, whose motion is alternate, and then his leisure is six hours instead of nine.

† See Report of Factory Committee, page 325.

the comparative high wages which factory workmen, whether children or adults, obtain. "Batting" cotton seems by far the most laborious employment in a factory; it is performed entirely by women, without any assistance from the steam-engine, and is at least as hard as thrashing corn, to which it has a great similarity; yet those engaged at it do not earn on an average more than 6s. 6*d*. weekly, while, close by, may be seen women, and even children of fourteen, earning double and treble that sum at stretching or power-loom weaving, in neither of which occupations is the labour one quarter as great. In power-loom weaving especially the manual labour seems to be really nothing, as those who work at it frequently follow the motion of the lay by leaning on it with their arms, with the view of taking exercise; it is also the healthiest of mill occupations. Were factory work in every department seriously detrimental to health, this circumstance would account for the high rate at which it is paid; but the evidence proves so strongly that such is not the case, that we are compelled to resort to some other explanation.

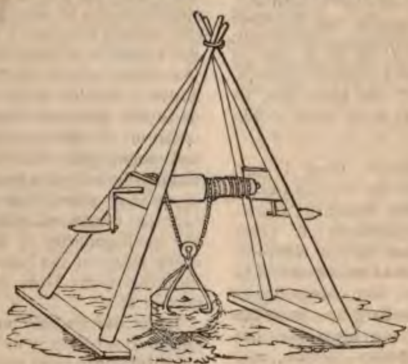
Shall I be better believed, when I state that I myself a short time ago was impressed with the common prejudice respecting steam-engines, viz. that employment at them tended to degrade a man into a machine, and deaden all the powers of his mind? The minute attention I have been compelled to pay to this subject in discharging the duties of this commission has convinced me that this is an idle and groundless notion, and in fact, in most instances, it is the reverse of truth. Whatever employments have this degrading tendency are among those in carrying on which no mechanical ingenuity has been applied: a workman of a superior class is always required to attend delicate or complicated machinery. Of course a child nine years old cannot be expected to display much skill in its work; but its education in factory labour must begin at that age, or it never can become a good skilled workman. Those who enter a mill at sixteen or seventeen always labour under great disadvantage, and earn comparatively little wages, from their inability to acquire that degree of tact and skill necessary to the due performance of factory work.

But the misrepresentations that have been put forth on the subject of the fine-spinning mills are perhaps the most extraordinary of all, I have no hesitation in saying that the labour in the fine-spinning mills of Manchester is lighter, pleasanter, and not less healthy than in any other mills in the town. The *lightness of the labour* is owing *to the slowness with which* the machinery moves in spinning fine numbers. The mule in spinning No. 30 or 40 makes in general three stretches a minute; in the high numbers only one, and sometimes less. This fact I have ascertained with the utmost precision by frequently timing the motion of the machine, holding a watch that marked the moments in my hand. During at least three-fourths of this minute the piecers, five of whom usually attend two mules, each containing 360 spindles, have literally nothing to do; they then stand listlessly by, their attention engaged by any thing but their work, till the mule recedes, when they instantly proceed to piece the threads which break, or are purposely broken (as in fine spinning, if a knot is perceived in any part of the yarn, it is intentionally broken). The piecing cannot take up long, as the mule has no sooner arrived at the frame than it instantly begins to advance, and when it has got about a foot and a half or two feet from the frame, it is impossible to reach over to the rollers, and the period of idleness begins. There is far less work for the scavengers to do in fine spinning than in coarse, on account of the waste being so much smaller, and consequently this part of the business is usually done by one of the piecers. Another superiority which these establishments have over the coarse-spinning factories consists in the small quantity of dust that is evolved in every stage of the process; in fact, in the spinning-rooms there may be said to be no dust at all.

I was particularly struck with the portly appearance of many of the spinners in these establishments; and one of the fattest men I saw in Manchester was spinning No. 180 in Mr. Houldsworth's factory, and he had been engaged in this work seventeen years. Another whom I questioned had been a fine spinner for thirty-six years, and he was employed in spinning No. 200 at the moment I spoke to him. One of the most violent witnesses for the Ten Hour Bill that I examined (*Thomas Wilson, page* 65, *Second Report*), says that his health was much better when he worked in a fine-spinning mill than in a coarse. In short, the fine-spinning mills, which have been made the object of such deadly hostility, are, scientifically speaking, the glory of Manchester. Nothing can exceed the beauty, delicacy, and ingenuity of the machinery, the order in which it is kept, or the extraordinary results it is capable of producing. I have seen cotton spun in them of the number 350; in other words, a pound of cotton is stretched to the incredible length of 294,000 yards, or 167 miles, and is then sold for twenty-five guineas, the original cost of it having been 3s. 8*d*. It is the only part too of the cotton-trade in which England is absolutely un-

rivalled, as, with the exception of some attempts that have been made in France, no other nation can approach us in this department of manufacturing. The export of fine yarn is increasing more rapidly than of any other description of cotton goods. It is impossible to keep the coarse-spinning mills in the same order as the fine, owing to the greater dust occasioned by the work, and the machinery not being required of equal delicacy. They have, however, other peculiarities, which make them at least as worthy of attention. For instance, there is not unfrequently attached to them a department for power-looms, which are among the most extraordinary machines in a factory. I have stood by one of these looms, and minuted its operations with a watch, when I have seen it weave seventy-two square inches of cloth in a minute, without any human being attending to it. In factories thus furnished the cotton enters in a raw state, and comes out as cloth; and of the numerous machines through which it has to pass, including the steam-engine which moves them all, there is not one that does not seem to demand the utmost stretch of human ingenuity to bring it to its present state,—not one that does not condense in its formation the result of at least a hundred patents, or that has not required in its invention the united efforts of at least a hundred minds.

APPLICATION OF THE DOUBLE AXLE TO THE UPROOTING OF TREES.



Sir,—I confess I was not a little surprised on reading a late article, in your publication, entitled "Practical Hints to Emigrants on the Clearing of Lands." Your correspondent has *invented* nothing more nor less than a lever of the first class, and talks about it as if we were living in the age anterior to that of Archimedes.

I should not thus express my surprise at this "practical hint," if I thought that the poor emigrants, for whom it was intended, would be in any way benefited by the adoption; but when I feel assured that not only loss of time, but loss of labour, and loss of material, would result from the experiment, I think it my duty to say two words, as a caution to those to whom time, labour, and material are objects.

In the first place, your correspondent speaks of "removing the earth round the *main stump, and cutting the* principal *branching roots* quite through," as an easy task, and one of secondary consideration. If he himself has ever lent his "practical" aid in uprooting a large tree, I think that he will agree with me, that the difficulty of clearing away the earth, in consequence of the continual and impenetrable resistance afforded by the dense mass of roots and fibres, constitutes the chief obstacle in the way of this always laborious undertaking.

In the next place, I should submit that the lever here intended to be used is totally unfit for the purpose; I put it to any one acquainted with the mechanical forces, whether "a long slender tree, like a scaffolding pole," would not yield to its own weight, much less be able to resist the necessary power. It is needless for me to say more; I will, however, suggest, that if the principle of the double axle be applied to this purpose, the power would be more than sufficient, and the advantages more than

compensate for the additional trouble of formation. I herewith send you a slight sketch of the manner in which I have applied this principle, and I feel confident that but a comparatively small exertion of force would tear up any tree in Canada, even without the assistance of spade or pick-axe. I remain, sir,

Your obedient servant,

CHRISTOPHER ROUTTEM.

Gower-street, May 5, 1834.

MANUFACTURES IN TIN, LEAD, COPPER, GOLD, AND SILVER.

The series of historical and descriptive treatises on the "Manufactures in Metal," in the Cabinet Cyclopædia, has just been completed by the publication of a third volume,* devoted chiefly to those very important branches of the subject, the manufactures in tin, lead, and copper, with their compounds, and in the more precious metals. We have already given our opinion on the merits of the two former volumes as they appeared—a favourable one upon the whole,—and we are glad to be able to say, that this third and concluding one is by no means the least valuable of the series. Its compiler has contrived, notwithstanding the immense extent and variety of the matters it embraces, to treat most of the processes which fall under his notice sufficiently in detail to make their "scope and tendency" intelligible to the reader, in spite of his having been compelled to devote one entire chapter to a matter entirely foreign;—we allude to that on optical instruments—"whereby hangs a tale." It may be remembered, that one of the most unaccountable defects of the excessively defective treatise on the Glass Manufacture in the Cabinet Cyclopædia, was the omission of all notice of the discoveries of our celebrated Dolland, while whole chapters were lavishly devoted to the infinitely less important inventions of sundry foreign artists, 'but little known to fame." Now, this chapter, in the present volume, on optical instruments, is, in spite of the palpable absurdity, appropriated to the filling up of the hiatus in its unworthy predecessor, under the plea that, as these instruments are generally mounted in metal, a description of that part of them must be perfectly in place. So far so good; but, unfortunately for the validity of the plea, *glass* soon begins to cut a far greater figure in the article than *brass*, and so continues to the end of the chapter! It would have been more *ingenuous*, if less *ingenious*, to admit the truth at once, and confess that the chapter in question had no business to be where it is, but ought to have formed part and parcel of a treatise published long ago, on a totally different subject! The cloven foot peeps forth a little again, in a note to the chapter on type-founding, in which one of the great conveniences of stereotyping is pointed out, by a reference to the case of Dr. Lardner's "Lectures on the Steam-engine," which, we are informed, have run through *five* editions (*credat Judæus!*) without requiring—or, at any rate, without receiving, any alterations or additions —*except in the three last chapters;* so that the body of the work is kept in stereotype, ready to supply copies, word for word, the same as the first edition, for a century to come! What a pity, that after all this, an incredulous public should still persist in suspecting that the booksellers' stale stock has had more to do with furnishing out these numerous editions than the printer's stock of stereo—type, or any other type whatever!

But a truce to digression; these blemishes are of no great consequence, and not so much the fruit of our author's demerits, as of his keeping "bad company:" to the same cause, also, may probably be attributed the want of a general index, which is to be given with a future volume of the Cyclopædia,—a History of Ireland, perhaps, or a Life of Oliver Cromwell, as the case may be! Nothing like system, especially in a series where every work is proclaimed to be complete in itself!

"Tin" is the first metal treated of in the volume, and a considerable body of various information is afforded on the history of the processes it goes through, in its numberless stages from the mine to the manufactory. The following extract refers to the spirit of enterprise so strikingly displayed by the Cornish tinners:—

* A Treatise on the Progressive Improvement and Present State of Manufactures in Metal. *Vol. III. Tin, Lead, Copper,* and other Metals. 1834. Longman and Co. Small 8vo., pp. 414.

"It is a most remarkable fact, that not only in hills and valleys, and from the plains, have the enterprising explorations of the tinners been conducted. Some of the Cornish mines have actually been carried to a considerable distance under the sea. Some of these submarine excavations, as described by Mr. Hawkins, display, in a striking manner, the effects of perseverance and the defiance of danger on the part of the miners. For instance, the noted mine of Huel Cok, in the parish of St. Just, which descends eighty fathoms, and extends itself forward under the bed of the sea, beyond low-water mark. In some places, the miners have only three fathoms of rock between them and the sea, so that they could hear very distinctly the movement and the noise of the waves. This noise is sometimes terrible, being of an extraordinary loudness, as the Atlantic Ocean is here many hundred leagues in breadth. In the mine the rolling of the stones and rocks over-head, which the sea moves along its bed, is plainly heard; the noise of which, mixed with the roaring of the waves, sounds like reiterated claps of thunder, and causes both admiration and terror in those who have the curiosity to go down.

"In one place, where the vein was very rich, they searched it with imprudence, and left but four feet of rock between the excavation and the bed of the sea. At high water the howling of the waves is heard in this place in so dreadful a manner, that even the miners who work near it have often taken to flight, supposing that the sea was going to break through the weak roof, and penetrate into the mine."—p. 14.

The history of tin-plate working, now a process in such extensive use, presents some highly interesting facts:—

"It is remarkable that the English, although they had so long a monopoly of the tin trade, and moreover possessed the richest mines in the world, should nevertheless have failed, as it appears, until a comparatively recent period, in their attempts at tin-plating. Beckman states, that, about the year 1670, a company sent to Saxony, at their expense, an ingenious man named Andrew Yarrenton, in order to learn the process of tinning. Having acquired there the necessary knowledge, he returned to England with some German workmen, and manufactured tin-plate, which met with general approbation. Before the company, however, could carry on business on any extensive scale, a man of some distinction having made himself acquainted with Yarrenton's process, obtained a patent for this art; and the first undertakers were obliged to give up their enterprise, which had cost them a great deal of money, and yet no use was made of the patent which had been obtained. Such is the account of the matter, as it stands in the account quoted: we may, however, reasonably doubt its absolute correctness, especially the intimation, that the process carried on by the English adventurer, and his German colleagues, was patented to an individual who himself purloined it.

"More certain and remarkable is it that, about the year 1720—which, on account of the many new schemes, and the deceptive trade carried on in consequence of them, will ever be memorable in the history of English folly—among the many bubbles, as they were then called, was the formation of an establishment for making tin-plate; and this was one of the few speculations of that period which were attended with advantage. The first manufactory of this kind was established in Monmouthshire, at the village of Pontypool, where tin-plate was afterwards so extensively and successfully prepared. Towards the latter end of the last century, tin-plate works were erected in this country, almost wherever the manufacture of iron was largely carried on; the perfection of the method of laminating the metal by means of rollers having more than any thing else contributed to the success of these undertakings.

* * * * * * *

The French call tin-plate by the expressive appellation of *fer blanc*, or white iron, which is exactly answerable to the *ferrum candidum* of the ancients, and a hundred talents of which were given as a present to Alexander in India. It is not reasonable, however, to suppose that this resemblance goes farther than the coincidence of terms, although it is difficult to guess what sort of metal the white iron of India can have been."—p. 27.

After "tin" is disposed of, we have chapters on Lead, Pewter, Zinc, and Britannia Metal, all of which include a good deal of valuable information. "Type-founding" succeeds; and to that three chapters on the various branches of Brass-works, in which is incorporated a very good description of the process of casting statuary in bronze; "Lamps and Brass-tubes," "Optical Instruments," and "Clocks and Watches," then furnish their fair proportion of matter,—the last subject being treated at considerable length; and "Brass Toys and Pins" (with a sketch of the celebrated Pin-making Machine), carry us on to the "Precious Metals,"

whose history is of course amply sufficient to fill some twenty or thirty pages of amusing narrative. Take a short anecdote as a specimen:—

"The goldsmiths of this country had considerable reputation in the middle ages. Anketil, a monk of St. Alban's, about the beginning of the 12th century, was so famous for his works in gold, silver, gilding, and jewellery, that he was invited by the King of Denmark to superintend his works in gold, and to be his banker or money-changer. A pair of candlesticks, made of silver and gold, and presented by Robert, Abbot of St. Alban's, to Pope Adrian IV, were so much esteemed for their exquisite workmanship, that they were consecrated to St. Peter; and were the principal means of obtaining high ecclesiastical distinctions for the abbey. According to Muratori, the English works in gold and silver were famous so early as the eighth century, even in Italy."—p. 376.

It might be observed, however, that the Pope alluded to had some natural predilections in favour of Anketil's workmanship, he having himself been born within the domains of St. Alban's Abbey, in whose favour he behaved so liberally: he was, in fact, the only Englishman who ever attained to the papal chair, and might naturally be expected to look with partiality on the production of his countryman. This says nothing, nevertheless, against the rest of the anecdote, as to the "Majesty of Denmark."

The manufacture of plate supplies the material of a chapter, which is about as good as any in the book. We can spare room only for a quotation relating to one of the most beautiful processes in the art:—

"One very ingenious department of the plate-working manufacture consists in what is called chasing or embossing; these terms being used respectively as the work is superficial or deep in the execution. To this practice the gold and silver smiths of antiquity are much indebted for the perfection of their wares; it is, indeed, a process which, next to the art of engraving, and with much greater effect, exhibits in wonderful perfection the designs of the draughtsman. It embodies not merely outline with bold relief but superadds diversity of texture, surface, and even colour; and some pieces wrought, of the precious metals, ornamented in the first style of the art, are of extraordinary value, and justly command universal admiration. Those who have seen the superb table services of the British Sovereign, or those of some of the other princes of Europe, as well as many in private hands, and especially the plate repositories of the celebrated house of Rundle and Bridges, on Ludgate-hill, will be able to judge of the truth of these remarks. The method of performing the work is very simple as to the details. The article being finished from the brazier, the design is, in the first place, delineated upon it in a very slight way; or, if it be not original, by means of red chalk and tracing-paper, as is done by engravers. The work, if at all hollow, as a tea-pot or a mug, and if the figures project considerably, is held upon a sand-bag, and the body of the design is bulged from the inside by the application of a hammer upon a knobbed rod, called a snarling-iron; the vessel is then filled with a composition of pitch and ashes from the grate, and rested upon the sand-bag during the operation on the outside, where the work is perfected. If it be a salver, or other flat article, it is imbedded upon a quantity of the composition laid on a board of the proper size, and having a hemispherical underpiece resting in a cavity on the work-bench, by which contrivance it is readily turned about by the chaser, so as to suit his convenience. The lines are then sunk by striking down upon and indenting the metal with little blunt steel punches, of shapes adapted to the figure. It would surprise a stranger to see with what facility a workman, by means of a small hammer, and about a score of simple tools, will bring up in bold relief the most elaborate designs."—p. 370.

"Plate" disposed of, the remaining pages of the volume are appropriated to the highly-contrasted subjects of "Button-making" and "Coining;" incongruous as they appear, we believe many a practitioner of the former has suffered the last penalty of the law for dabbling in the latter mystery,—so closely do the working parts of the two *trades* assimilate. The description of the operations of the Mint brings the history to its conclusion.

Taken altogether, we are inclined to think that this volume is the best of the three devoted to the Metal Manufactures: it is free from any of the glaring faults which, in parts, disfigure the "History of Iron and Steel," while it possesses many recommendations of its own, besides the great one of the extent, variety, and importance of the subjects it embraces.

THE ART OF WINE-MAKING.

Mr. Booth, whose treatise on the Art of Brewing we lately noticed,* has just produced another Treatise on the kindred "Art of Wine-making;"† or, to speak more properly, a volume supplementary to the former. The general principles, and many of the manipulations of the two arts are so similar, that the business of this new treatise consists mainly in pointing out those peculiarities by which the manufacture of wine differs from that of beer; and the two treatises are so intimately connected, that the one cannot be profitably perused without constant reference to the other. As Mr. Booth himself observes, "the four parts of the Art of Brewing and these two of Wine-making, with the Appendix on Cider and Perry, may be considered as one continued work, embracing a general system for the manufacture of vinous liquors."

Mr. Booth, in his present work, treats, first, of "Wine-making in Warm Countries," and next of "Wine-making in Cold Countries;" or, in other words, of Foreign and Home-made Wines in all their numerous varieties. He gives, under both these heads, a great deal of very useful (though not often very novel) information, derived from the most authentic sources, and interspersed with much shrewd observation and judicious advice. One of his best chapters relates to the much-contested point, whether open or close tuns are best suited to the process of fermentation? The ancient practice of the wine provinces of France was to leave the tuns open, or, at least, to cover them very slightly; but at the beginning of the present century, a Mademoiselle Gervais introduced a close fermenting apparatus (afterwards patented in Great Britain by Messrs. Deurbrouck and Nichols), which having the good luck to be patronised by the celebrated Chaptal, has become all the fashion among our French neighbours. According to the partisans of this new method, it serves not only "to condense, and to return into the fermenting fluid all the aqueous, spiritous, and balsamic vapours, which are usually carried off with the carbonic acid gas, and thereby to enrich the wine, by preserving entire its spirit and perfume," but actually augments the quantity of wine obtained, by from 9 to 15 per cent. Mr. Booth does not altogether dispute these conclusions, but he insists that they are prodigiously exaggerated. He maintains that the increase of volume is "not above one in two hundred;"—that "this increase is caused by the condensation of all the gas that is evolved during the whole progress of the fermentation;"—and that the proportion of this condensation, which is spirituous, is probably "very small."

We shall leave Mr. Booth, however, to speak for himself. He commences very properly by describing what the Gervais apparatus is, and how it has been proposed by M. Dubrunfaut to free it of its more striking defects.

"Z Z, A A,* is the perpendicular and central section of a fermenting-tun, with the apparatus affixed to the close head Z Z.

"B is a cone of tinned iron-plate, communicating at bottom with the tun, by means of a hole in the cover Z Z.

"C C is a small channel extending round the interior base of the cone, being adapted to receive the condensed '*alcohol* and *essential oils;*' from whence they are conducted, down the small pipe D, into the lower part of the liquor in the vat.

"E E is a cylinder of the same material as the cone which it surrounds, and containing

* We may take this opportunity of doing an act of justice to a highly respectable body of brewers, who are thought by some persons to have been rather unhandsomely dealt with, by our manner of quoting Mr. Booth's observations respecting them. We allude to the Burton ale-brewers. Since writing our critique on Mr. Booth's book, we have made inquiries of our own into the modes of practice by which this justly celebrated beverage is produced—inquiries addressed not only to various scientific men, who have carefully analysed specimens of the ale in question, indiscriminately selected at different periods, but to persons who are practically conversant with the brewing business, and who, from being rivals in trade of the Burton gentlemen, cannot be supposed to have any bias in their favour—and we are now perfectly satisfied that there is not the slightest ground for imputing to them the use of any deleterious or prohibited ingredient whatever. The Burton ale is indebted for its acknowledged excellence partly to the quality of the water employed, which happens to be largely impregnated with sulphate of lime, but in a still greater degree to the brewers using the very best of malt, and plenty of it—brewing only at the most fitting seasons of the year—brewing slowly, and in (comparatively speaking) small quantities at a time.

† The Art of Wine-making in all its Branches. *By David Booth. To which is added, an Appendix concerning Cider* and Perry. London: F. J. *Mason. 123 pp 8vo.*

* See fig. 1 on our front page.

cold water for the purpose of condensing the vapours which rise into the cone during the fermentation.

"F is an egress-pipe, communicating with the interior of the cone; its extremity being immersed to the depth of six inches, at least, below the surface of the water in the small tub G, from whence the incondensable gases are permitted to escape into the atmosphere.

"H is a cock to draw off the water from the reservoir E E, when it becomes warm and requires to be replaced with cold water; as is the case in high fermentations.

"It is asserted by the French chemists, and conceded by Messrs. Deurbrouck and Nichols, the English patentees, that the vinous fermentation will not commence without the access of atmospheric air or of oxygen; but after it has once begun, the further exposure to the air is unnecessary; and the quantity contained in the empty space (left in the tun to prevent the head from rising into the cone) is, they say, perfectly sufficient to originate the fermentation: but, they add, 'as soon as carbonic acid is evolved from the fermenting gyle, the atmospheric air, being lighter, is driven out from the upper part of the working-tun; and, as no air is permitted to enter afterwards, all the subsequent carbonic acid gas emitted diminishes the quantity of oxygen contained in the gyle, by the oxygen uniting with the carbon as fast as it disunites from the saccharine matter during its decomposition, and thereby secures a soundness and peculiar mildness not to be procured by any other mode.'

"Never having seen the effects of fermentation in tuns thus, as it were, hermetically sealed, we cannot personally join in their praise; but we apprehend that there is one inherent defect, which will always prevent their general adoption in the British brewery;—we mean the tardiness of the progress of the fermentation. From fifteen to twenty days, which, it is granted, would be requisite for the fermentation of table-beer, is a sufficient bar to its adoption. On this principle, we suppose that the Scotch ale-brewers, who, even with open tuns, often take three or four weeks to a gyle, would require the whole of their brewing-season for a single operation.

"It will be observed, in the preceding description of the Gervais apparatus, that the extremity of the *egress pipe* F is immersed in water *to the depth of six inches at least.* These six inches impose an additional pressure upon the surface of the fermenting fluid, equivalent, at an average, to the sixty-fourth part of the whole weight of the atmosphere; and, in consequence, *has a material effect in preventing the escape of the carbonic acid, thereby retarding* the attenuation. 'In fact,' *says M. Dubrunfaut,* 'the gas, meeting with a powerful obstacle, which opposes its passage through this condensing apparatus, forces its way by other issues, which it finds in the pores of the wood, and the fissures of the lutes which are recommended to close the joints of the cover of the tun. The portion of the gas which thus escapes, by openings that can never be kept closed under such a pressure, subtracts the alcoholic vapours from the refrigerator, and is a fundamental error in the construction of the Gervais apparatus.' We may add, that had it even been perfect, it was not new: it was nothing more than a combination of two principles which had been long known—the condenser of Jean Baptiste Porto, a Neapolitan, which was described in a work on Distillation, published by him in 1609; and the hydraulic valve of M. D. Casbois, which was announced in a French Journal of Sciences and the Arts in 1783.

"It will naturally be asked, in this place, whether or not the rise in the barometer, to the extent of about half an inch, would not have the same effect on the vinous fermentation as the Gervais apparatus? We say, that it would have more: for, in the case of an increased weight of the atmosphere, the pressure all around the tun would be equal to that upon the surface of the liquid. One marked difference would be, that there would be no exit through the pores or chinks of the tun; for these fissures would be equally pressed upon by the external atmosphere. We have been long aware that the variations of the barometer are indicative of alterations in fermentative processes of every kind; and we doubt not that a time will arrive, when that instrument will be considered as a necessary appendage to the other instruments which are now consulted by the manufacturers of vinous liquors. Persons who have not attended to this particular subject (and there are few who have), can have no conception of the effects of atmospherical variations. Wine-making is confined to a certain season, and to countries where the variation of the barometer is comparatively small: it is the regions of the north that those effects are more particularly worthy of observation. On this subject we have made many experiments; but what might be useful as suggestions to a scientific manufacturer, would be here out of place. As long as the mind remains doubtful of the facts, they ought not to be given to the world as *knowledge.*

"The author last quoted has proposed a mode of close fermentation, which is free from the errors and absurdities that attach to that of Mademoiselle Gervais; and as it may be useful in the vinous fermentations of this country, and does not interfere with the English patent above mentioned, we

take this opportunity of publishing a brief description of the process:—

"A and B, in figure 2, represent two of any number of fermenting tuns, which may be arranged and combined on the same principle. They are here reprinted as of the same size, and as placed on the same horizontal level; but these circumstances, though convenient, are not necessary. The lines *a a* and *b b* mark the surface of the *must*, or other fermentable liquid.

"D D is a pipe, communicating with each tun by means of branches, which are inserted through the close head; and which may be stopped at any time, by means of the stop-cocks *c c*.

"C is a cask, or other vessel, filled with cold water, through which the pipe D D is continued in the form of a worm *o, o, o, o, o*: this water may be drawn off, when too warm, by means of the cock *d*, when this refrigerator can be re-filled with cold water, through an opening in the head.

"E is a smaller vessel, or tub, destined to receive the product of the condensation of the vapours arising from any or all the fermenting tuns. Those vapours, rising in the branch-pipes *c c*, into the main D D, pass through the worm *o, o, o, o, o*, which is bent, when it leaves the refrigerator, into the tub E, reaching half-way to its bottom.

"It will be obvious, from this arrangement, that the condensable vapours, which arise with the carbonic acid gas, will, by passing through the refrigerator, be collected at the bottom of the tub E in a fluid form, while the upper part of the tub will be filled with gas. Care must be taken to draw off portions of this fluid from time to time (by means of a cock in the bottom of the tub, which is not here represented), so that it may never rise above the level of the orifice of the worm; for were the fluid, for example, to rise to the level *e, e*, it would, according to its gravity, form an hydraulic valve, which would cause an additional pressure upon the surface of the fermenting liquid;—the prominent objection to the Gervais apparatus.

"On this plan, the complex apparatus for each tun is rendered unnecessary; for a single one, of sufficient size, will serve for any number of working tuns. The condensed liquid is not hereby returned to cool the fermenting mass; and the distiller, for whom we should suppose the practice well adapted, might carry the liquid from the tub E directly to the still. It may, however, be returned into the mass, by a long-stalked funnel, if desired. The worm gives a free *passage to* the vapours; since its lower extremity, *being plunged only in* carbonic acid *gas, cannot be said to offer* any obstruction. *The liquid in the tun* is then fermented solely under the simple pressure of the atmosphere; and the carbonic acid gas, finding an easy escape through the opening of the worm, no longer seeks to force a passage through the pores of the wood or the chinks of the tun.

"The gas, which, on account of its density, constantly fills the tub E, prevents all risk of absorption of atmospheric air as completely as is done by the hydrostatic valve of Gervais. When there is a range of tuns, one or more will be continually discharging carbonic acid gas; but where there is only a single tun, and that not in full operation, the accession of air could be equally well prevented; for it would only be necessary to fill the tub with water until the surface should rise two or three-tenths of an inch above the lower extremity of the worm, as shewn by the line *e e*.

"When we want, at any time, to look at the state of a tun, we have only to shut the cock *c* (which shuts out all communication with the others), and, opening a plug-hole in the head, draw off what we require by means of the cock at the bottom. In the same manner we may charge and discharge the several tuns successively, without their interfering with one another. Each may be washed out, by having a *man-hole* in the upper end; or, it may even be taken away, and replaced by another, without retarding the operations of its neighbours. For the more easy performance of this latter purpose, M. Dubrunfaut recommends the following disposition of certain parts in the construction of the apparatus:—

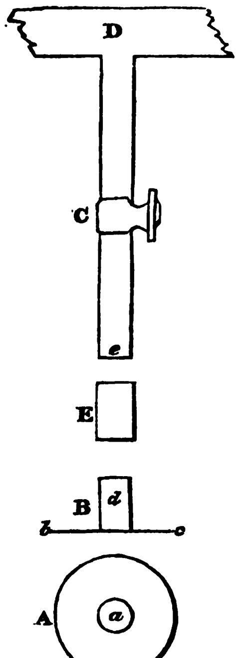
"Fig. 3 represents, on a larger scale than that of fig. 2, the pieces necessary for the purpose above mentioned.

"B is a tube and flange, seen sideways, of which A is the face, being a circular plate of the diameter of its section *b c*. This piece is fixed by nailing the disc *b c* upon the head of the tun, in such a manner that the opening *a* corresponds with the hole which is made in the head of the tun, for the purpose of allowing the escape of the gas: the tube *d*, of which *a* is an extremity, being of the same diameter as the hole.

"The tube *d*, which is thus perpendicular to the head of the tun, is of the same diameter as the tube *e* of the piece C; and these two tubes, when the apparatus is finished, will be united at their orifices, so as to form a single continued pipe. In order to close completely any little openings between their orifices, the cylinder E, the diameter of which is a little larger than that of the tubes *d* and *e*, is drawn over the junction, and its extremities are luted to those tubes so as to prevent all access of air or escape of gas. The piece C is previously united to the larger tube D, which here re-

presents a part of D D, fig. 2. From this disposition of the parts, it is easy to see, that by shutting the cock of the piece C, and pushing upwards the moveable socket E, the tun may be completely disengaged, without affecting any other part of the general arrangement.

Fig. 3.



"We have dwelt the longer on this subject, because of its probable adoption by the distiller and vinegar-maker, for whom we should suppose the close fermentation to be better adapted than to the brewer, or even to the foreign wine-maker. The produce will be found to be very various, according to the heat of the fermentation and the quality of the fermenting fluid. At an average, perhaps, it may be estimated at about the two-hundredth part of the quantity of liquid that is fermented; and in quality, chiefly water mixed with a small portion of alcohol, or, rather, of the immediate materials of alcohol."—pp. 16-23.

On the adulteration of foreign wines, we have the following acute remarks:—

"*To the inhabitants of this country it is of much less importance to know* how any particular species of foreign wine is manufactured, than to learn how to guard themselves from the effects of its adulteration. The following observations may, perhaps, account for an occasional accident, and at the same time may serve as a caution to the bottlers of wine in this country.

"We have already mentioned, that the bottled wines of the Continent (particularly champagne) undergo at least one or two *decantings* or *rackings* in the bottles, before they are exported. A *bin* of wine is tried, to see whether or not it is fit for the foreign market. The practice is (especially in the wine of which we speak) to use very fine, that is, elastic corks; to push them half into the bottle; and to press the upper part over the neck, in a sort of girth or rim, which is kept down by means of twisted wire. This cover of the top of the bottle is recovered with wax of a certain colour, and what that colour is, depends on the substances with which the wax is mixed. If it be yellow, the colouring matter is orpiment; and if it be green, the colour is usually given by a mixture of orpiment and Prussian blue. Both these colouring matters are poisonous; for orpiment is sulphuret of arsenic; and Prussian blue is formed from one of the most instantaneous poisons—the prussic, or as it is now termed, hydrocyanic acid.

"Let us suppose then that a bin of champagne is intended to be exported, or if in a British cellar, to be sent to a customer. A bottle is drawn for trial, and is found to be deficient in effervescence. This can be remedied by inducing a new fermentation; and we know that it is the practice to accelerate this desirable quality by means of the introduction of a syrup of sugar-candy, mixed, and purified with cream of tartar. This addition, which is put into the bottle in proportion to the taste of the customers, is certainly not deleterious. But, the cork is drawn, the seal is broken, and a part, perhaps a few chips, of the wax, is rubbed off, and enters into the bottle. If the colour has been either green or yellow, arsenic also enters; and, unfortunately, the world is but too well acquainted with the consequences. We may also add, that in French cellars, the wax has another object in view besides (what is generally thought) the exclusion of the atmospheric air. In that country there are numerous swarms of insects, who are ready to devour the corks, and penetrate to the liquid. As far as regards these insects, the poisonous quality of the colouring matter is not to be regretted."—p. 52.

A danger of a less formidable nature to be guarded against, is the substitution of certain home-made imitations for the

genuine products of the continental vineyards:—

"Of all the vinous liquors which are manufactured in this country, beer and ale, cider and perry, (and mead and mum, when not banished by Excise regulations,) are the only kinds that can be called national. The juices of most of our native fruits possess too little *saccharum* to be fermented pure; and when malt wort or honey was formerly added, as sugar has been in late times, the compound was also flavoured and coloured with extraneous substances, so as to imitate one or other of the favourite wines of the Continent. This was more particularly attended to when the making of 'sweets,' or 'British wines,' became a trade. The imitation of foreign wines originated in fraud, and Excise duties raised the imitators to the rank of authorised manufacturers. As long as these gentlemen were contented with the ordinary names of currant wine, gooseberry wine, &c., all was well; but we now see champagne, sherry, port, &c. in the bills of the British wine-makers, and we have little doubt that some of these compounds occasionally find their way into the cellars of the 'dealers in foreign wines.' Champagne, in particular, is a very high-priced article; and the British champagne, made from gooseberries, if properly made and drunk when young, may impose upon three-fourths of the purchasers. Perry, also, particularly in mixture, is passed off for champagne, and is, perhaps, not much inferior to the real wine which it imitates. It is not so much the inferiority as *the lie* which passes a cheaply-made article for one that is more expensive, that constitutes the quackery and the crime of those ingenious imitators. If we can make a British wine equal to champagne, we have a right to do so; but we have no right to pass it off *in trade* as a foreign wine."—pp. 61, 2.

In the "Appendix concerning Cider and Perry," Mr. Booth represents the English manufacture of both these liquids to be in a very declining state. His observations on the subject are well deserving of attention:—

"We have reason to believe that the superior sorts of perry, as well as of cider, though they may have the same names, are not equal to what were sold for such forty or fifty years ago. Most of the trees that were famed for the excellence of their produce are either dying or dead. Mr. Marshall published his Rural Economy of Gloucestershire in 1789, at which period he laments the decay of the finest fruit trees. 'All the old fruits,' he says, 'which raised the fame of the liquors of this county (Herefordshire), are now lost, or so far on the decline as to be deemed irrecoverable. The *red streak* is given up; the celebrated *stire apple* is going off; and the *squash pear*, which has probably furnished this country with more *champagne* than was ever imported into it, can no longer be got to flourish; the stocks canker and are unproductive.' The squash pear is described as remarkable for the tenderness of its flesh, which bursts (or rather *bursted*) if allowed to fall ripe from the tree; and hence the name."—pp. 119, 120.

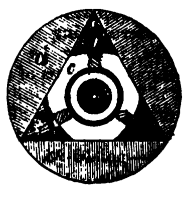
The pity is the greater, that our British perry is (or rather was) a species of wine particularly worthy of cultivation:—

"Perry, when the manufacture has been successful, is much more similar than cider to the sweet wines of the grape. Without any mixture it has often been taken for the best quality of effervescing champagne. The juice, mixed with an equal quantity of a purified syrup of sugar or of honey, of about 25 lbs. gravity (being allowed to finish its fermentation, so as to be bright before bottling), is scarcely to be distinguished from a foreign wine of a superior species."—p. 121.

HEATON'S IMPROVED METALLIC PISTON.

Sir,—Among the many ingenious contrivances employed by Messrs. Heaton, Brothers, to render their steam-carriage as complete as possible, I noticed the following improved method of constructing Barton's expanding metallic piston, which is well worthy of being made public.

In Barton's piston, the three springs which force out the wedges reach against the piston-rod, and are quite independent of each other. In this piston, as constructed by the Messrs. Heaton, a more perfect arrangement exists, which will be made intelligible by the following sketch:—



aaa are the three metal segments; *bbb* are the protruding wedges acted

upon by three spiral springs, which re-act separately and simultaneously against a steel ring, C, which surrounds the piston-rod at some little distance. The advantage of this arrangement consists in the uniform distribution of pressure throughout the apparatus.

In the event of one spring being much stronger than another, in Barton's mode of construction, one wedge is pushed forward with more force than the others, and unequal wearing is the consequence; in Heaton's piston, on the contrary, any excess of strength in one spring is met by the yielding of the others,—the most perfect self-adjustment taking place.

The ring, C, is itself a spring to a certain extent, aiding and assisting the action of the others; and although it may not always be found in the centre of the piston, yet will it invariably be found in the true *centre of the combined forces*, producing the most perfect equilibrium in all the parts, and thus affording a steam-tight piston, with a minimum quantity of pressure, and, consequently, of friction also.

I may state, that in Messrs. Heaton's engine, the weight of the piston and piston-rod was sufficient to overcome all the friction of the piston and stuffing-box, and to cause the descent of the piston in the cylinder, being at the same time perfectly steam-tight.

I remain, sir,

Yours, respectfully,

WM. BADDELEY.

10, Wilderness row, Goswell-street,
May 13, 1834.

FOREIGN ZINC PLATE.

Sir,—Allow me to assist in rescuing foreign zinc sheet plate from a portion of that obloquy which has been cast upon it, in consequence of the frequent use of an inferior article, which has been found inadequate to the several purposes to which it has been applied, as you have ably and satisfactorily explained in your Journal, No. 552, page 378.

Nearly four years ago, at a brewery in this place, the lead with which two liquor (water) backs were lined was taken out, in consequence of leakage to a considerable extent, and the lead was found to be perforated with an innumerable quantity of very small holes. One back is placed under cover of a roof, and the other uncovered on the outside of the roof. The cause of the perforations I imagine is an acid, acquired by the water from sulphate of lime,—the springs supplying the town passing over a bed of chalk.

The same backs (made of English oak) were then lined with some of Mosselman's zinc sheets, and continued in use about two years, when a leak was discovered in the vicinity of the valve, communicating with the copper. Upon examination, it was found that in a circle of about 1½ foot diameter round the valve, there were a great many holes similar to those discovered in the lead. I then gave directions to have the zinc lining of both backs painted in two coats of white lead paint, which was done; and the holes being well filled with the paint, the leakage ceased, and has not since returned. If I had been aware of the intention to strip the backs of their lead lining, I should have recommended the application of paint instead, and have no doubt but that it would have been found quite sufficient to prevent leaking. The cause of the perforations existing around the valve, and not elsewhere, I attribute to the acid of the water, assisted by friction.

The action of the water upon the internal surface of lead suction pipes, placed in many of the wells in this town, is precisely similar to what was observed in the sheet lead in the backs referred to, rendering them useless in a very short period, in consequence of their drawing air through the perforations.

As an experimental measure, I caused a suction pipe, thus rendered useless, to be replaced with a new one, painted inside and out. The inside painting was effected by pouring in some white lead paint, and coating the pipe by agitation. For about a fortnight after the completion of the work, the water from the pump was strongly impregnated in taste and smell with the paint, and of course not fit for domestic purposes; but subsequently to that period was drawn perfectly sweet. As this was done, how-

ever, no longer than about eight months ago, a sufficient time has not yet elapsed to ascertain the result. I am,

Sir, your obedient servant,

G. A.

Brighton, May 12,1834.

Sir,—The attention of the public has lately been much solicited in favour of zinc; and though its advocates have not yet rendered it fire-proof, still from their eagerness to make it vie with copper, it is to be expected that ere long they will—in *their prospectuses at least*—totally banish the latter metal from our roof trees, and kitchens. Zinc has, doubtless, its merits; for the purposes of roofing it infinitely excels lead, being more malleable, and proportionably lighter; for guttering, &c., it is also very applicable. Neither can there be any doubt that it would have been much earlier in use, had not the quality of the metal hitherto used in this country been very bad, being contaminated with a considerable portion of iron, from the scaling off of the oxide of which, a hole is soon formed in the sheet wherever it predominates. The Liege metal, to which your article of the 8th March, 1834, refers, is certainly much purer; on this an oxide forms rapidly, but evenly, and free from any disposition to scale off; consequently, the sheet remains of its pristine thickness. These properties point it out as an admirable material for roofing, but *on one condition*, which is positive, namely, that it should be always fastened with *zinc* nails, and should no where come in contact with iron or copper, where exposed to moisture; otherwise a violent galvanic action takes place, and both the fastening and the metal become corroded. It is to this particular consequence I would direct the attention of the public. As long as the use of zinc is confined to roofing, zinc nails are sufficiently strong to attach the sheets to the laths or rafters; but the advocates of zinc are very desirous to extend its application to the covering of ships' bottoms. Now, mark the consequences. Wherever the zinc sheathing touches the copper or iron employed in fastening the vessel, there ensues a hole; the chafe of the water soon extends the fissure, and very soon the greater part of the sheathing is off. Nor is this all; a much more serious sequel is to be apprehended. The bolts which fasten the main fabric of the vessel are themselves acted upon, and become loose; the ship leaks, works at sea, and finally is destroyed. This is no imaginary evil. The very same thing happened on the first introduction of copper. Ships were then universally fastened with *iron*, which still is preferable in point of strength; the first ships that were coppered, became soon, to the dismay of the projectors, loose and leaky, technically cally *iron-sick*. What was to be done? To renounce the advantages of sheathing was out of the question. Copper afforded too good a protection against attacks of the terrible worm to be discarded at the first failure, to say nothing of the exemption from careening to clean their bottoms, and superiority in sailing. It was then found that copper bolts answered all the purposes of iron, and hence ships were principally fastened with copper; not, be it remembered, on account of the superiority of copper as a material for bolting, but because it enables them to be *sheathed* with it. But to what will those who recommend zinc have recourse, since from iron and copper they have excluded themselves? They have suggested to bolt with *zinc*,—lead, perhaps, might answer the purpose as well!

The above are facts that have come before my own eyes. You have admitted zinc to plead its cause in your columns; let, in fairness, copper be also heard. It is not merely on that ground, however, that I wish for the insertion of this communication; but that, perhaps, the perusal of it may hinder some shipowner from trying, without reflection, an experiment, which will cost him dearer than the experience gained will repay.

I am, sir,

Yours obediently,

A Shipwright.

EXTENT OF THE RESISTANCE OF THE AIR TO LOCOMOTION.

Sir,—As a constant reader of your useful Magazine, I shall feel obliged by your inserting a few observations on the subject of atmospheric pressure (respecting which so much has been said) against a locomotive steam-engine, proceeding on a level railway, at a velocity of 100 miles an hour, when the atmosphere is in a quiescent state.

I am aware that some of your correspondents may consider my opinions as extravagant and absurd; I am, however, content with plain practical facts, to which the most scientific must sooner or later be willing to accede; and being neither a mathematician nor an engineer, I run no risk of losing my reputation.

The question appears to lie in a very small compass. The resistance of the atmosphere, in a quiescent state, to the motion of a locomotive engine proceeding on a level railway, with a velocity of 100 miles an hour, would be precisely equal in effect to a strong gale of wind proceeding at the same velocity of 100 miles an hour on the same engine-carriage, without steam or other power. We may, I think, conclude that the effect would not be very great of such a wind, from the fact which occurs continually to the observation of every individual—namely, the effect of the atmosphere during a gale of wind, moving at the rate of 100 miles an hour (and, perhaps, much more), in direct opposition to the progress and advance of a stage-coach with four horses, which must oppose a resistance *fully equal to that of the atmosphere on an engine-carriage moving with the same velocity*, impelled by steam, through a quiescent atmosphere. We do not find that the horses are arrested in their progress by such a wind, or that the coach and passengers are much impeded by an opposing atmosphere moving at such a velocity, though the horses, coach, and passengers, combined, present a much greater surface to its action than 30 square feet. Perhaps an instance was never known of an additional pair of horses being attached to overcome the resistance of such a storm, though it continually occurs, and is found indispensably necessary, from bad roads. The usual and utmost effect has been a little delay. If the locomotive engine were passing through the dense medium of water, the specific gravity of which is to air as about 800 to 1, the opposing force of resistance to a velocity of 100 miles an hour would be immense, because the water, from its density, could not fill up the run of the engine-carriage with sufficient velocity, so as by its pressure behind to counterbalance the opposing or resisting pressure in front. But the case is totally different *with a carriage on a level railway passing through the atmosphere*, which, in a quiescent state, would oppose resistance only as 1 to 800 compared with water. A carriage moving with that velocity on a railway would scarcely feel such resistance, because the atmosphere, from its extreme rarity, and a pressure of 15 pounds to the inch, is calculated to fill up the partial vacuum made by the passage of the engine, with a velocity far superior to that of 100 miles an hour; consequently, the pressure at the back of the carriage (and all around it) would be always equal to the pressure in front.

Viewing the railway system as being yet in its infancy, I have no hesitation in giving it as my opinion, however chimerical it may appear to some of your professional readers and correspondents, that a carriage, on a level railway, moved by a moderate gale of 60 miles an hour, acting upon a sail of proper dimensions, and going before the wind, will be found to move with a rapidity equal to three-fourths of the velocity of the wind, because upon a railway there is comparatively no friction, and that little more power would be necessary than to overcome the inertia of the carriage. The narrowness of the railway would, however, be, no doubt, a considerable drawback on such a mode of transit.

I am, sir,
Your obedient servant,
W. ALDERSEY.

Homerton, near Hackney.

CHAIN CABLES.

Sir,—Since the introduction of chain in lieu of hemp cables for the use of ships, the capsizing of what is termed the windlass pauls has been a subject of general complaint. Having had a practice of thirty years in the marine-smith line, it has occurred to me, that this defect arises from the diameter of the windlass barrel not exceeding that of the body of the windlass including the whelks; the consequence of which is, that when the ship is riding at anchor, the half diameter of the chain-cable is above the bearing points of the pauls, and of course there is little or no strain on the centre gudgeons. I propose to increase the diameter of the windlass barrel to about 4 or 5 inches above the surface of the whelks (for ships of about 200 tons). By this means more

of the strain of the chain-cable would be transferred to the centre gudgeons, which would materially relieve that on the pauls, and prevent many disasters. I would recommend the common cast-iron pauls, in preference to what is termed the jumper, as this last works with too much weight on the windlass barrel, and wears its channelled surface in a very short time. I think it will not be necessary to increase the weight of metal in the manufacturing of this description of windlass barrels, as they may be made much less in depth than those now in use, or concave at the ends, in the manner of a cast-iron gun-carriage wheel.

I am, sir,
Your very humble servant,
GEORGE ENNIS.

Island of Jersey, May 14, 1834.

TYSON'S IMPROVED FLOUR-DRYING APPARATUS.

A very valuable improvement in the process of kiln-drying wheaten flour, has been lately introduced at the extensive flour-mills of Mr. Nathan Tyson, of Baltimore. We extract the following documents on the subject from the "Franklin Journal" for April last:—

Specification of Patent granted to Mr. Tyson, August 8, 1831.

"To all whom it may concern, be it known, that I, Nathan Tyson, of the city of Baltimore, in the state of Maryland, have invented certain improvements in the kiln-dryer, patented by Oliver Evans, on the 22nd day of January, 1808, as specified by him among certain 'inventions of improvements in the process of the art of manufacturing grain into flour or meal, and for other purposes;' by which improvements in the mode of preparing wheat-flour and other kinds of meal for packing, their tendency to sour, or to become otherwise injured by keeping, if not altogether obviated, is much decreased; and that the following is a full and exact description of the same.

"It is a well-established fact, that the various species of fermentation which take place in vegetable matter, are not produced by temperature alone, but require the presence of a certain portion of moisture. The advantage derived from the kiln-drying of grain and of meal depends upon this principle; and my improvement consists in a *more effectual and beneficial* mode of accomplishing the end proposed, than any of those which have been heretofore adopted.

"I take the flour, or meal, either as it leaves the mill-stones, or after it has been submitted to the process of bolting, and cause it to pass through cylindrical or other suitable tubes, or boxes, to which a revolving or vibratory motion is to be given, and in which the flour, or meal, is subjected to the action of steam or of heated air. The tubes, or boxes, may be constructed either of wood or of metal, according to circumstances, and they may be suspended and moved in the manner of the common bolter. Within the cylinder or other apparatus, containing the flour, or meal, to be dried, I generally place small ledges, which may stand perpendicular to such cylinder or other apparatus, and project to such height from its inner surface, and have such direction, either parallel with or inclined to its ends, as may appear best calculated to detain, conduct, or agitate the flour, or meal, and expose it for the requisite time to the influence of the artificial heat employed.

"When heated air is used as the drying agent, the cylinder or box containing the flour or meal may be made to revolve within a long oven, or kiln, with the ends of said cylinder open to receive and deliver the flour or meal. I sometimes, however, intend to enclose the cylinder entirely within the oven, or kiln; a tube will, in this case pass through the cover to admit the flour, or meal, to be dried, which will then escape through another tube at the opposite end. When so constructed, the heated air will not only surround, but be contained within, the cylinder or box.

"When steam is applied for the purpose of drying the flour or meal, I surround the tube, or box, which in this case must be made of metal, or other good conductor, with an exterior case, or jacket, within which it revolves; a sufficient space being allowed between the two for the passage of the steam or heated air, which is to be admitted from a boiler, or stove, properly constructed, and conveniently situated for that purpose; such connecting tubes, dampers, and valves, being attached to the apparatus as may be required, according to the various modifications of which it is susceptible. The steam may be admitted through a hollow gudgeon, and allowed to escape in the same way, there being tubes to conduct it to and from the space provided for it.

"Instead of the revolving cylinder, or box, I intend sometimes to construct a cylindrical, or other, chamber, with suitable floors or shelves, one above the other, upon the upper one of which the flour, or meal, may be received, whence it may pass to those below it, being stirred and carried by *hopper boys*, or

other suitable contrivances. Heated air will, in this case, be admitted into the chamber, and have its exit through suitable openings. For steam, the floors or shelves must be made double, and the steam pass through them in ways well known to every mechanist.

"A current of air, sufficient to carry off the moisture, separated from the flour or meal, must in all cases be admitted into the cylinder, or box, in which the flour, or meal, is contained. In most cases, no particular provision need be made for this purpose; and where this may be requisite, the means of doing it are too obvious to require description. The drawings deposited in the patent-office will serve to illustrate the process and apparatus herein described; but I do not intend to confine myself to any particular form, construction, or position of the tube, or box, or of the other parts or modifications of the apparatus. A series of convoluted tubes may be employed, forming a structure like that of the screw of Archimedes; and, indeed, an almost infinite variety of shapes may be given to the apparatus, all operating upon the same principle, and producing the same effect, with equal, or nearly equal, advantage.

"What I claim as new, and for which I ask a patent, is my improvement in the drying of flour, or meal, either bolted or unbolted, by means of the application of steam, or of heated air, in an apparatus constructed in the manner and upon the principle hereinbefore described.

"NATHAN TYSON."

Remarks by Dr. Jones, the Superintendent of the Patent-office, Washington, and Editor of the Franklin Journal.

"When the plan was first made known to the editor, he had no hesitation in declaring that it must prove perfectly successful; as, without the presence of moisture, that fermentation which produces souring cannot take place. It is not a little remarkable, that a plan so simple, and so rational, should not have been adopted long since. The kiln-drying of grain is a well-known process, and modes of cooling and drying the flour after it has left the stones have been universally employed; and, indeed, every step, excepting this last and most important one, had been previously taken. We published in vol. vii. p. 102, a communication from one conversant with the subject, on the souring of American flour, and more especially of that from the western country. It was there recommended to employ a wind-fan to blow cool, fresh air, among the meal as it issues from the stones, and in other parts of its manufacture, for the purpose of drying it. Now to effect *this object fully*, it is manifest that instead of *cool* air, that which is *warm* and dry is the most proper agent.

"It appears that from eight to twelve pounds of moisture may be expelled from a barrel of flour, when in the state in which it is usually packed. The greater part, if not the whole, of this moisture, might undoubtedly be discharged in carefully kiln-drying the grain, but the consequence of this would be that superfine flour could not be made from it, as nearly the whole of the bran would be chopped up by the stones. It is probable, too, that a much higher degree of heat would be required to separate the moisture from the grain than from the flour.

* * * * *

"It would be difficult to magnify the importance of an improvement in the manufacturing of flour, which effectually prevent its souring; as this is not an effect produced upon a solitary barrel or two, but not unfrequently upon whole cargoes, which become sour even during the time of short voyages to the West Indies, or the southern portion of our continent; and, indeed, large quantities arrive at New Orleans in this state, although shipped on the waters of the Ohio, immediately after it is packed in barrels. A large portion of that put up for sea stores, on all long voyages, is thus lost; and but few persons would credit the account, were we able to state the proportionate quantity of that so shipped on board our vessels of war, which is eventually thrown overboard, as totally spoiled."

Extract of a Letter from Mr. Tyson to Dr. Jones, dated Baltimore, March 1, 1834.

"'In accordance with thy request, I now inform thee that my flour-drying apparatus has been in successful operation for upwards of two years, during which time I have prepared many thousand barrels of flour, which has been shipped to every quarter of the globe, and has stood the test of all climates for from six to twelve months, *without any deterioration whatever*. Advices from Gibraltar and the West Indies inform me, that, after laying eight or ten months, my flour was found to be quite as "perfect as though just from the mill." Within a few days past I have received the amount of the sales of a lot which I shipped in December, 1832, to Liberia, in Africa, with instructions to keep it twelve months, when it was sold, and proved to be *perfectly sound*.

"'Amongst the many to whom I have sold largely of the kiln-dried flour, is the very respectable house of William Patterson and Sons, of this city, a copy of whose certificate is annexed. In no instance whatever have I had a complaint of the dried flour not keeping perfectly; in several instances, a few

barrels have been brought back from the East Indies and the Pacific Ocean, and always in as perfect a state as when first made.' "

CERTIFICATES.

" 'I do hereby certify, that I have purchased from time to time a considerable quantity of dried flour, which I shipped to the West Indies and South America—say Brazils, and round Cape Horn. That in every instance this flour kept perfectly sweet, and that I believe it would keep sweet for years in almost any climate.

(Signed) " 'WM. PATTERSON.' "

" '*Baltimore, Feb.* 15, 1834.' "

" 'I have visited Mr. Nathan Tyson's mills, and seen his flour-drying machinery in operation, and have no hesitation in pronouncing it an important discovery, and that flour thus prepared must necessarily keep perfectly for a long time.

(Signed) " 'SAML. STUMP,
" '*General Inspector of Flour.*' "

" '*Baltimore, Feb.* 15, 1834.' "

ON THE PHENOMENA OF FLAME. BY J. O. N. RUTTER, ESQ.

" As in mathematics, so in natural philosophy, the investigation of difficult things by the method of analysis ought ever to precede the method of composition. This analysis consists in making experiments and observations, and in drawing general conclusions from them by induction, and admitting of no objections against the conclusions but such as are taken from experiments or certain other truths. For hypotheses are not to be regarded in experimental philosophy."

SIR ISAAC NEWTON.

The design of the following paper is to bring together a variety of experiments which may be considered as illustrative of the phenomena of flame. By applying to them the canon of philosophical research so beautifully described by Newton, we may, perhaps, arrive at conclusions at once instructive and satisfactory. It is very agreeable, and sometimes very convenient, to take shelter beneath the influence of great names. This love of ease, when the investigation of an intricate subject is concerned, tends very often to perpetuate error. Whenever acknowledged difficulties present themselves, they ought to be fairly met, rigidly examined—and, if possible, immediately removed. A course the very opposite to this is frequently pursued by *very excellent* and *very learned* men; among whom are some of the most popular scientific writers of the present day. With book-makers it is a common practice to transfer the opinions, and, in many cases, the very words of others, to their own columns, without examination; and, not unfrequently, without acknowledgment.

As the papers of Sym and Davies on Flame, referred to by Dr. Thompson, in his Treatise on " Heat and Electricity," 8vo. London, 1830, p. 310, are not accessible to me, I have no means of ascertaining whether the following experiments have, or have not, been already described. If I have been anticipated in the whole of these investigations,* I can see no reason for rejecting, or undervaluing, on that account, the information they supply.

1. If a piece of wire-gauze be brought down gradually upon the flame of a taper, or candle, the section of the flame, when viewed from above through the wire-gauze, will appear as a ring of light surrounding the wick, but not in contact with it.

2. A jet of coal-gas will present a similar appearance. The orifice of the jet may be very distinctly seen in the interior of the flame.

3. If the wire-gauze be brought down in the way already mentioned, upon a flame of coal-gas issuing from an Argand burner, the section of the flame will exhibit two distinct rings of light, and the thickness of the burner will determine the distance between the rings.

4. If an Argand lamp, with a wick supplied with oil, be employed, the thickness of the wick will determine the distance between the rings.

5. When air is excluded from the interior of an Argand burner, the flame, whether it be that arising from gas or oil, which was previously cylindrical, assumes a conical form. Let the wire-gauze be brought down upon this flame, and there will be, as in the case of the taper, or the jet, (1, 2,) one ring of light corresponding with the exterior surface of the wick or burner (3, 4).

6. The flames of alcohol and of hydrogen gas, present, in every respect, the same phenomena as those described (1, 2,

* I observe that Mr. Watson, Mechanics' Magazine, No. 551, page 362, has anticipated one of my experiments. I am hence induced to hold them all with a loose hand.

, 4, 5,) excepting, of course, in the quality of the light.

7. Phosphorus, if inflamed in contact with the atmosphere, and the wire-gauze brought down upon it, exhibits a ring of light. The experiment requires a little caution and dexterity. The opacity of the interior of the flame may, however, be very distinctly recognised.

8. If we take about ⅞ths of an inch of wax taper, insert it in a piece of glass tube the same length, employing as a foot to the taper so enclosed a disc of cork, sufficiently large to keep it steady; then, in a saucer, or evaporating dish, coil some filaments of lamp cotton, so as to form a ring about two inches in diameter, and ⅞ths of an inch in height; saturate the ring of cotton with alcohol, light the taper, place it in the centre of the ring and inflame the alcohol, the taper will be extinguished. The heat in the interior of the flame of alcohol will be sufficiently intense to vaporise the wax, which vapour will be decomposed and inflamed at the summit of the alcoholic flame, imparting to it a characteristic brilliancy; but the wick of the taper will not be inflamed if the process be properly conducted. To ensure success in this experiment, we must guard against any agitation in the surrounding atmosphere, by moving about the room, opening or shutting doors, or breathing too freely in the immediate vicinity of the alcoholic flame. After observing all these precautions, we shall probably find that the flame will be in a continued flutter, occasioned by a current of rarefied air, and the taper will be alternately extinguished and relighted, just in proportion as the unsteadiness of the flame prevails or subsides.

9. Instead of a taper (8), if we place a piece of phosphorus in a small metallic spoon,* inflame it and pass it into the interior of the alcoholic flame, the phosphorus will be extinguished; suddenly withdraw it, it will inflame; pass it again into the interior, and it will again be extinguished.

The phosphorus, as already remarked of the taper, may be vaporised; and the vapour will become luminous as it enters into combination with oxygen at the summit of the alcoholic flame. Should it happen that the phosphorus has not been properly dried, small particles of it will be thrown out on every side: these will inflame the instant they come in contact with the external atmosphere.

10. We may vary this experiment by placing in the interiors of the alcoholic flame (8) a small metallic cup,* containing alcohol, ether, or spirit of turpentine. These materials may be vaporised, but they will not inflame in the cup as long as the alcoholic flame preserves its conical form.

11. If phosphorus (9) be placed in the centre of the flame of an argand burner, (3, 4,) to which atmospheric air has access, it will inflame. If the further ingress of air be prevented, the flame will become conical (5), and the phosphorus will be extinguished.

12. The result will be still more instructive, if we repeat the last experiment in an Argand burner supplied with coal-gas, the ingress of air to its interior being prevented. Let the phosphorus be ignited and passed into the interior of the gas flame, the phosphorus will be extinguished. Turn off the gas, the phosphorus will be inflamed; turn on the gas, that will be inflamed, whilst the phosphorus will be again extinguished. (10). If we employ alcohol, ether, or spirit of turpentine, in an Argand burner, supplied with oil or coal-gas, the results will be more uniform and satisfactory than with a large flame of alcohol, for the reasons already stated (8).

13. A lighted taper placed in the interior of the flame of an Argand burner, will continue to burn so as air has access to it: exclude the air (5), and the taper will be extinguished. We may vary this experiment by employing a jet of coal-gas instead of the taper. The result will be the same in both cases.

14. If a coil of platinum wire be held above the flame of alcohol, the wire will become incandescent. If we pass the wire into the interior of the flame, its incandescence will cease. In this experiment the effect will be more intelligible if we employ a spirit lamp with an Argand wick. The incandescence of the wire may be determined or prevented, by the admission or exclusion of air (11).

* *A spoon for this purpose may be conveniently formed by flattening one end of a piece of copper wire.*

* For cheapness and convenience, say part of a child's thimble.

15. Instead of an Argand wick we may employ a common fibrous wick of cotton, say 1 inch in diameter, and it may be supplied with tallow, oil, or alcohol. The phenomena will be the same as those already described (5, 8, 9, 10).

16. If a stream of oxygen gas be projected from below into the interior of a conical flame (5, 6, 15), we shall observe the unusual phenomena, of one flame within another.

17. A stream of oxygen gas, or of atmospheric air, projected upon any of the materials before mentioned, viz. phosphorus, ether, alcohol, spirit of turpentine, a jet of coal-gas, or a taper, will produce an inflammation; but the inflammation will continue in the respective materials only so long as the supply of gas, or of air, is maintained.

18. If any of the materials just enumerated be placed in actual contact with the flames of tallow, oil, alcohol, or gas, whether interiorly or exteriorly, inflammation will ensue; but the combustion of the respective materials will be less perfect and less energetic when enveloped in the flame of some other body than when they are inflamed, under ordinary circumstances, in contact with atmospheric air.

19. The flame of an explosive mixture of coal and oxygen gases is of a pale blue colour; and the greater the proportions of oxygen, within the limits of saturation,* the smaller is the flame, and the fainter is its hue, as compared with an equal volume of coal-gas when burning in the usual way. Similar phenomena present themselves in an explosive mixture of coal-gas and of atmospheric air. In the latter case, the colour of the flame is somewhat deeper.

20. It is almost unnecessary to remark, that the flame of an explosive mixture of oxygen and hydrogen gases is of so pale a colour, as to be scarcely perceptible in day-light. This is not its most remarkable quality.

21. If a stream of hydrogen gas be ignited at the point of a jet, by bringing down upon it a piece of wire-gauze (2), we may ascertain that the flame is hollow. If a stream of oxygen gas be projected from a similar jet, in the same direction, and in immediate contact with the hydrogen, we shall find, that notwithstanding the additional supply of gas, (the proper proportions being ½ a volume of oxygen to 1 volume of hydrogen,) the flame will be immediately very sensibly diminished in size, and it will no longer appear hollow. Further: in the flame from hydrogen alone, the greatest intensity of heat will be found near to its extremity, at the apex of the cone. It is not so with the oxy-hydrogen flame—the point of greatest intensity in that being near the base of the cone, where the greatest quantities of the two gases first enter into chemical union.

22. The analysis of coal gas teaches us that when it is of good quality, (sp. gr. 475 h. 550) each volume will require for its complete combustion nearly two volumes of oxygen: one volume of oxygen combining with an equal volume of carbon, producing carbonic acid; the other volume of oxygen, by its union with two volumes of hydrogen (condensed into one volume as it exists in carburetted hydrogen), forming water.

23. The analysis of coal-gas also enables us to understand the habits of explosive mixtures, and especially those of carburetted hydrogen (fire damp) and atmospheric air. Thus, when the relative proportions of inflammable gas and of air are as one volume of the former to five volumes of the latter, the mixture is not explosive; but if the quantity of air be gradually increased from five to ten or even twelve volumes, the mixture detonates with increasing violence at every additional volume of air up to the point of saturation.*

* *I employ this term for want of a better. By the limits of saturation, I mean those proportions of oxygen with coal gas most favourable to inflammation or explosion.*

* See preceding note. As a familiar illustration of these phenomena, we may suppose 100 cubic inches of coal-gas to be mixed with 500 cubic inches of atmospheric air. The mixture will not be explosive, because it will not contain a sufficiency of oxygen to support its inflammation—500 inches of air containing only about 100 inches of oxygen—and 100 inches of coal-gas requiring 200 inches of oxygen for its complete combustion. If, however, 100 inches of coal-gas be mixed with 1,000 inches of air, the mixture will be explosive, since it will contain the relative proportions of the inflammable gas and the supporter most favourable to inflammation or explosion. We know that when coal-gas, or the fire-damp of mines, is mixed with air, in proportions of one volume of the two former to any number of volumes intermediate between 5 and 10 of the latter, the mixture is explosive; but it is only so to a certain extent. When the proportions of air exceed 12 or 12½ volumes of inflammable gas, the mixture is not explosive—an excess of oxygen having, in this respect, the same effect as its deficiency.

24. That mixtures of explosive gases whose relative proportions are adapted to form most readily new compounds, will detonate with the greatest violence; and *vice versâ*.

25. Explosive mixtures of coal-gas, or carburetted hydrogen, and of oxygen, are subject to the same laws as mixtures of the same inflammable gases with atmospheric air. The former explode more uniformly, and more promptly, than the latter. This is a result we may expect, since, in the former instance, the particles of inflammable gas, and its supporter, must be in more intimate union than can possibly happen in the latter instance, through the interference of the azotic gas present in atmospheric air.

26. Those mixtures of explosive gases inflame the most readily through narrow tubes, and the interstices of wire-gauze, whose relative proportions are best adapted for forming new compounds. We have no difficulty in understanding how it is that explosive mixtures inflame so readily in narrow tubes and in close vessels, if we bear in mind that the elements of combustion are arranged, in such mixtures, under the most favourable circumstances; and hence they require no aid from fresh accessions of oxygen externally applied.

27. If we apply a blow-pipe to the flame of a candle, a lamp, or a jet of coal-gas, we shall find a greater intensity of heat will be obtained by projecting a stream of air across the flame near its base, than by projecting a similar stream across the upper portion or apex of the flame. We may obtain satisfactory proofs that these views are correct, if we consult any intelligent artificer who is in the habit of using the blow-pipe.

28. If we pass a piece of wire-gauze across the base of a jet of coal-gas (in the blue portion of the flame), the gas will continue to burn above the gauze as well as below it, and no free carbon will be deposited on the under side of the gauze; nor will there be any set at liberty from the flame above the gauze. By passing the gauze upwards, and holding it near to the apex of the flame, we shall perceive a different result. Free carbon will be deposited in abundance on the *under side of the gauze*, the flame *above it will be extinguished, and*, as the *gauze becomes heated*, a dense vapour of carbon will pass through, which may be inflamed.

29. This experiment may be varied, by substituting for a jet of coal-gas the flame of a wax taper, a common candle or an oil lamp. Instead of wire-gauze, if we pass a piece of writing paper or card-board into the blue portion of the flame it will not be tarnished; we may repeat the same process about half-way up the flame, and with the same result; but if we ascend towards the apex of the flame, the paper or the card will be blackened by the deposition of free carbon. Finally:—if we hold the paper or card above the flame it will not be blackened, a proof that no free carbon escapes into the atmosphere.*

30. An equal quantity of oxygen will combine with a given quantity of coal-gas, or of carburretted hydrogen gas, under circumstances very dissimilar, and producing in one case a very feeble, and in the other a very brilliant light. Thus, two volumes of oxygen being mixed with one volume of coal-gas, and the mixture inflamed as it issues from a jet, the flame will be small, of a pale blue colour, and afford a very feeble light (19). One volume of coal-gas, with ten volumes of air, will produce a similar effect, the flame being of a somewhat deeper colour (19). When coal-gas is inflamed in an atmosphere of oxygen gas, the flame is larger than ordinary, and the light from it exceedingly brilliant; and, as already mentioned, the same quantity of oxygen combines with a given quantity of the inflammable gas, as in the two former instances. The resulting compounds are alike in quantity and in character in each case (22).† The phenomena that accompany the combustion of coal-gas, under ordinary circumstances, for the purposes of artificial illumination, are so well known, that they can need no particular description.

31. If the flame of an explosive mixture of coal-gas and oxygen, or atmospheric air, be treated with wire gauze

* The process of introducing and withdrawing the paper or card must, of course, occupy only a moment. The flame employed should be so trimmed as to be free from smoke.

† Such frequent reference is made to coal-gas, because, now that gas-light is making rapid progress among the provincial towns of this kingdom, there will be greater facilities than formerly for obtaining it in researches of this kind. I object to the employment of the generic term carburetted hydrogen in a sense synonymous with coal-gas.

or card-board, as already described (28, 29), it will be found that no free carbon will be liberated at any part of the flame, either within it or above it.

32. If there be projected upon a flame of coal-gas a strong current of air, the flame will immediately be diminished in size, and it will exhibit all the properties of the flame of an explosive mixture (19, 31).

33. In an attentive observation of the combustion of an explosive mixture of coal-gas, or carburetted hydrogen and atmospheric air, within a safety-lamp, we shall be sure to notice how speedily the flame from the wick will be extinguished. It will not, I suppose, be denied that this is occasioned by the absence of oxygen.

34. It may be ascertained by mere inspection, that the flame of the mixture within the lamp is hollow. Towards the top of the lamp the flame will sometimes assume a more brilliant aspect than at any other part. It more frequently happens, however, that free carbon (smoke) will escape from the top of the lamp.

35. If it be inquired whence arises the luminosity of the flame at the upper part of the lamp, or, in its absence, the free carbon (smoke), already mentioned, I reply, that whilst the explosive mixture burns within the cage, the heat evolved will be sufficient to carry on the vaporisation of the oil in the reservoir of the lamp. This vapour, occupying, in a partial degree at least, the interior of the flame, will be converted into oil-gas; and if there be present in the explosive mixture a large proportion of oxygen, a part of the gas will be decomposed, exhibiting its peculiar brilliancy (45). But should there be only a small proportion of oxygen present, the nascent oil-gas will not become luminous, although it may be decomposed, and hence the separation of free carbon (smoke).

36. That the view here taken of the vaporisation of the oil is correct, may be satisfactorily proved by employing, in a similar mixture of explosive gases, two safety-lamps; one with the wick and the reservoir of oil adapted in the usual way; the other with a temporary wax wick attached to the reservoir, but without any *oil therein*. *The re-lighting* of the wick, *on the re-admission of* oxygen to the lamp containing, oil is, under these circumstances, perfectly intelligible (16, 17).

37. An explosive mixture will burn tranquilly within a safety-lamp, without raising the wire gauze to a temperature that will communicate inflammation to the surrounding atmosphere of explosive gases, so long as that atmosphere remains undisturbed; but if the lamp be exposed to a current of the explosive gases, the flame within the lamp will be driven against the wire-gauze at the side opposite to that whence the current flows, and then the gas will become sufficiently heated to permit the flame to pass through, or to communicate inflammation to the external atmosphere.

38. Those explosive mixtures, the proportionals of whose elements assimilate the nearest to two volumes of hydrogen and one volume of oxygen, yield by combustion the greatest quantity of heat from a given volume of the mixture. Hence it is easy to understand that the relative proportions of a third element, as carbon in carburetted hydrogen, and azote in atmospheric air, determine the specific temperature of the mixtures in which they may be present.

39. The security afforded by the use of a cage of wire gauze in an explosive atmosphere, is not entirely due to the radiating properties of the metal. The temperature, at any particular part, of a large cylindrical film of flame of an explosive mixture, burning tranquilly within a safety-lamp, will be very inferior to that arising from the combustion of the same materials under different circumstances. The vaporisation of the oil (35) will engage a portion of the heat given out by the combination of the gases. But there is another condition that demands especial notice. Whilst a current of the explosive mixture is flowing *inwards* through the interstices of the gauze at the base of the cage, which current, from its temperature and direction, cannot possibly communicate inflammation to the external atmosphere—a similar current of non-explosive materials (aqueous vapour, carbonic acid gas, free carbon, and azotic gas) must be necessarily flowing *outwards* near the top of the lamp.*

* The comparatively low temperature of the flame of explosive mixtures present in coal-mines, is doubtless owing, in a great measure, to the vast quantities of azotic gas contained in those mixtures.

When these tranquil currents are disturbed by a sudden rush of the explosive atmosphere, or of comparatively fresh air, then it is that explosion ensues.

40. The phenomena that accompany the tranquil combination of explosive mixtures, at a temperature below that which is sufficient to inflame them, are so numerous and so interesting, especially when viewed in connexion with Mr. Faraday's late researches into the action of platina upon gaseous bodies, that they will require a separate notice.

41. Having thus enumerated, with a minuteness that it is feared will be considered by some as unnecessary, a variety of phenomena connected with flame, it now remains that we should inquire if the facts eliminated support and illustrate the theory of flame, as announced by Sir H. Davy, and the views which are advanced by other writers, some of whom stand deservedly high in the scientific world.

42. It is stated by Davy, in his Treatise on the Safety Lamp, 8vo., London, 1825, p. 46:—

That "the flame of combustible bodies, in all cases, must be considered as the combustion of an *explosive mixture* of inflammable gas, or vapour and air; for it cannot be regarded as a mere combustion at the surface of contact of the inflammable matter; and the fact is proved by holding a taper or a piece of burning phosphorus within a large flame made by the combustion of alcohol, the flame of the candle or of the phosphorus will appear in the centre of the other flame, proving that there is oxygen even in its interior part."

Dr. Ure, Dict. Chem. 4th edit. London, 1831, has quoted verbatim the above paragraph, Art. Combustion, p. 357, without acknowledgment. He has also enriched his pages by copious extracts from Davy's work throughout the same article.

Dr. Graham, Chem. Catechism, 2d edit., London, 1829, Art. Combustion, p. 589, also quotes, without acknowledgment, a part of the paragraph. In a note there is the following piece of information:—

"The form of flame is conical, because the greatest heat is in the centre of the *inflammable mixture.*"

Dr. Thompson says, in his admirable Treatise on Heat and Electricity, 8vo., London, 1830, p. 309:—

"Flame is the rapid combustion of volatilized matter. The tallow or the wax is melted and drawn up to the top of the wick of a candle. Here it is boiled and converted into vapour, which ascends in the form of a column. This vapour is raised to such a temperature, that it combines rapidly with the oxygen of the surrounding atmosphere, and the heat evolved is such as to heat the vapour to whiteness. Flame, then, is merely volatile combustible matter heated white hot. The combustion can only take place in that part of the column of hot vapour that is in contact with the atmosphere, namely, the exterior surface. The flame of the candle, then, is merely a thin film of white hot vapour, enclosing within it a quantity of hot vapour which, for want of oxygen, is incapable of burning."

Dr. Lardner, Cab. Cyc., Treatise on Heat, p. 358, seems to entertain similar views to those expressed by Dr. Thompson. By the frequent interchange of the terms "gas" and "vapour," the passage in the Cab. Cyc. is, however, rendered somewhat obscure.

43. If we observe with attention the flame of a combustible body with whose habits we are familiar, say, for example, a common tallow candle, it will be found to exhibit the following phenomena. The tallow being liquefied by the proximity of a burning body, rises, by capillary attraction, between the filaments of the wick. As it approaches the flame it is converted into vapour, from which state it readily passes into that of gas. The flame not being in actual contact with the wick (1), the vaporisation of the tallow goes on simultaneously at every part of the wick surrounded by the flame. The blue portion of the flame, at its base, as well as the fainter film of blue that surrounds its other parts, denote the chemical union of carburetted hydrogen and oxygen gases (19, 30, 31). As this union is a continuous process, accompanied by the evolution of heat, a temperature is speedily attained of sufficient intensity to decompose a great proportion of the nascent inflammable gas. By this decomposition successive portions of carbon are separated from hydrogen. The hydrogen combines with oxygen, forming water; the carbon at this elevated temperature becomes luminous, and combining also

with oxygen, yields carbonic acid gas (22).

44. It will be seen that I do not agree with Dr Thompson (42), who maintains, that the flame of a candle "is merely a thin film of white hot *vapour*." We are accustomed to say, that the vapour of certain bodies, as of alcohol, or ether, is inflammable; but I consider the inflammability of these vapours is due entirely to the facility with which they are convertible into gases under certain specific conditions, and the influence of a certain temperature.*

45. If the view we have taken be correct (43), it seems that the combustion of a tallow-candle involves a somewhat complicated, yet, if carefully analysed, an exceedingly beautiful process. It is a conical film of luminous matter (1), changing gradually upwards, from blue to white. It contains, in its interior, nascent inflammable gas; but no oxygen. (15, 16). At the very base of this film of flame, at a temperature which may be termed specifically its own, we may perceive indications that a chemical union is going on between carburetted hydrogen and oxygen gases; aqueous vapour and carbonic acid gas being projected from the flame at this part.† The supply of inflammable gas from within being constant and regular, and an equally uninterrupted supply of oxygen being established by the rarefaction of that portion of air in the immediate vicinity of the flame, the heat given out by the sudden union of one portion of inflammable gas with oxygen, is sufficient to decompose a larger portion of the same material. To the latter part of the process are we indebted for the illuminating properties of the flame. Hence also those important distinctions perceptible in different parts of the same flame (30).

46. The flame of combustible bodies cannot, therefore, "in all cases, be regarded as the combustion of an ***explosive mixture*** of inflammable gas, or vapour and air;" but as the tranquil and progressive combination of inflammable gas with oxygen. The combustion of explosive mixtures differs from that of a common candle, or coal-gas (19, 20, 30, 31, 43, 44, 45), inasmuch, that in one case there is an immediate combination of all the inflammable gas with oxygen; in the other, a part only so combines, whilst the greater portion undergoes decomposition previous to its ultimate combination (29). The resultants are the same in both cases; but the conditions that produce them essentially differ.

47. What has been said respecting the flame of a candle may be applied, without difficulty, to the flame of those combustible bodies with which we are familiar in the ordinary affairs of life. The flame of a tallow candle, an oil lamp, and a coal fire, present not only similar, but identical phenomena. The flame of coal-gas differs from each of the preceding. In the three former there is a vaporisation of the elements of the combustible body,—a spontaneous, or, if I may employ the term, an extemporaneous transition of this vapour to gas; then follows inflammation, decomposition, and re-composition. In the latter case the gas being previously generated, inflammation is the first stage in the process of combustion: the subsequent stages are identical.*

48. That all the vapour arising from a combustible body is not, excepting under particular circumstances, converted into gas, is abundantly evident by the free

* Some have maintained that the bodies we designate gaseous are nothing more than vapours. I here only speak of things as we find them. If gases are vapours, we know them to be more complex and refined, as regards the arrangement of their particles, than vapours, in the popular acceptation of the term. Should it be objected that vapours of certain inflammable bodies detonate, if mixed with oxygen, in the same way as explosive mixtures of gases. I have only to reply that the detonation is the result of the sudden and spontaneous evolution of gas, and its re-union with the oxygen present. These processes may be the work only of 1-100th or 5-100th part of a second.

† To ascertain this fact by experiment, the follow-simple means may be employed:—If a piece of cold glass, or polished metal, be held near the blue part of the flame, aqueous vapour will be projected upon it. 2. If a drop of a saturated solution of lime (lime-water) be held at the end of a small glass rod or tube near the blue flame, the water will become turbid—carbonic acid gas combining with the lime and separating it from the water. *This latter experiment must be the work of a moment, or we may be deceived by simply vaporising the water.*

* The quality of the light from different bodies will depend—all other circumstances being the same—on the qualities of the combustible body. The most intensely white light evidently contains a greater portion of olefiant gas than a dull yellow light. It is not, however, unworthy of remark, that very much depends on the management of the materials. A tallow candle, with a small compact wick, will yield a more brilliant light—I mean as to its quality—than a similar candle with a large fibrous wick. What is usually termed the perfect combustion of the materials is, in fact, only another term for the perfect combination of all the inflammable elements with oxygen.

carbon (smoke) that arises from a candle, a lamp, and a coal fire. Equally evident is it that certain conditions must be observed in effecting the combination of all the elements of a previously prepared gaseous body with oxygen. This we learn by the free carbon (smoke) given off from coal-gas, when too much is admitted to the burner.

49. Those bodies which contain a large portion of carbon as compared with their other elements, require different management from those whose elements of inflammability assimilate in more exact proportions. It will be sufficient to mention, and to place in juxta-position,

Ether.........Spirit of turpentine.
Sperm oil......Coal tar.

In ether and in sperm oil, hydrogen and carbon exist in such proportions, that they readily pass through the several stages already described (47), and form, with oxygen, new compounds.* Spirit of turpentine and coal-tar, containing, on the contrary, an excess of carbon, require a different treatment to effect their entire combination with oxygen.

50. It is inexplicable why Davy employed a larger flame of alcohol in his researches in preference to a smaller one, since it is so difficult to conduct with the former a fair and accurate experiment, whilst with the latter the results are uniform and conclusive (8, 12); we have no difficulty in ascertaining that flame is hollow (1, 2, 3, 4, 5, 6, 7); we have the most conclusive evidence that oxygen exists not in the interior of flame (8, 9, 10, 12, 13, 14, 15, 16, 17); not even in that of explosive mixtures (33). And equally certain is it, that the habits of explosive mixtures are very unlike those exhibited by combustible bodies under ordinary circumstances (19, 20, 21, 23, 30, 31). Further, we may not only satisfy ourselves that the flame of a candle or lamp is conical and hollow, but we may ascertain that it does not consist only of a thin film of luminous matter, and that combustion takes place only at the surface where the inflammable gas comes in contact with oxygen. Thus, the flame from an Argand burner, when air has access to its interior, is not only cylindrical but hollow, *i.e.* it consists of two concentric cylinders, or films of luminous matter (3, 4), whilst the flame from the same burner, when air is excluded from its interior, consists only of one cylinder, or an external film (5). Difficult as it may be to understand how so eminent a philosopher as Davy could have erred in relation to this subject, I think we have no alternative but to reject his theory of flame, since it is wholly unsupported by fact and experiment. This will be done, I have no doubt, by all who, unbiassed by prejudice, and unawed by great names, will take the trouble to investigate the matter for themselves.

J. O. N. RUTTER.

Lymington, Hants, May 14, 1834.

* It may not be improper to remark, that when aqueous vapour exists in an inflammable body, as in alcohol and ether, there must of necessity be oxygen present. When, however, the vapour of this body is converted into gas (44), the oxygen does not act the part of a supporter; but by combining with half its *volume of oxygen* yields carbonic *oxide, which, under favourable circumstances, becomes, by the addition* of another half *volume of oxygen, carbonic acid.*

HISTORICAL SKETCH OF THE BRITISH COINAGE.

[From a Report, in the *Athenæum*, of a *Lecture on Coins and Medals, delivered at the Society of Arts by W. Wyon, A. R. A., Chief Engraver at the Royal Mint, May* 13.]

The coins of the ancient Britons, previous to the arrival of the Romans (notwithstanding many specimens remain), are so little known, that very few can be appropriated with any certainty, with the exception of those of Cunobeline; some, indeed, are attributed to Boadicea, and one is engraved as of Segonax. Many of the coins of Cunobeline, however, exhibit a considerable advance in the art, which induce a belief, as well from the design as execution, that they must have been the work of Roman artists; they are found in gold, silver, and copper. During the occupation of Britain by the Romans, from 43 to 448, or about 400 years, it is probable that the circulation was confined to Roman monies.

The Saxons introduced three denominations of coin—the Sceatta and Penny in silver, and the Styca in copper; the latter is believed to have been entirely confined to the kingdom of Northumbria. The earliest Saxon coin that can be appropriated is a Sceatta of Ethilberht, King of Kent, who began to reign in 561; this description of coin seems to have lasted but a very short period, and to have been succeeded by the penny, a-

early as the reign of Eadvald, King of Mercia, in 716, from whom we have almost an uninterrupted series to the present day. Snelling says, "No nation in Europe can exhibit such a succession of coins, with the portraits of sovereigns, as the English, from the Conquest;" but he might have gone two centuries further back, as the portrait of Offa, King of Mercia, 758, is upon his coins. The coinage of Offa is remarkable for its superiority of workmanship and variety of type, as compared with any other of the Saxons. From his time we have a complete series of pennies, with the heads of the monarchs, to the Conquest, with the exception of Edmund Ironside, none of whose coins are now known; these pennies have the monarch's name and title on the obverse. Baldred, King of Kent, 805, was the first monarch who added the place of mintage on the coins. From Offa to Alfred the workmanship appears to have regularly declined; Alfred, however, made some attempts to improve the coinage, for we see some of his coins with the monogram of London on the reverse, that have the character of better workmanship. William the Conqueror continued the same kind of money. The coins from the conquest have one exception or break in the series of portraits (if indeed such uncouth representations may be so called), which is that of Richard I., none of whose English coins occur, though a well-known dealer some years ago fabricated two specimens for the curious of that day; there is, however, reason to believe that coins were struck in England during his reign; and if any be hereafter discovered, they will most probably bear his portrait, although his Anglo-Gallic money is without it. With the exception of the coins of Edmund and Richard I. all have portraits. The effigies of a prince, said Mr. Wyon, ought not to be looked upon as merely stamped for ornament or honour, or to proclaim and set forth his titles, and where and when he reigned, but as public vouchers of the real and intrinsic value of money, according to the constant and general estimation of the world; the prerogative of the supreme magistrate in this respect being recognised by the subject, and allowed to none beside.

The penny was the largest piece coined *previous to the reign of* Edward III., unless the patterns for groats we the first or second Edward, which i doubtful. Edward III. coined and half groats.

Gold was first coined in Engla Henry III., 1257, three or four spec of which are still preserved; and i curious fact, that its circulation w titioned against by the citizens of Lo Edward III. was the first prince gold coin was circulated,—since time it has been common in En An unique gold coin of Edward usually termed a half florin, is i British Museum, also a quarter the only instance of coins of that mination having been struck in Eng they are of great value, more espe the first. The high prices occasi given for such rude specimens of coi are worthy of some mention. In 1 coin of Ethelred was submitted to auction, and sold for the sum of 26*l* one of Hardyknute for 28*l*., and in a coin of Alfred for 40*l*. 19*s*.

Though many of these, as speci of the art, are extremely rude, the of Edward III. (struck on his great victory), on which he appears in a asserting the British dominion o ocean, even in uncouth execution (it is not), would of right be regarde curiosity, if not veneration. In the of Henry VII. we first find the c arms upon the reverse of the coi also first introduced the shilling; gether a decided improvement m observed about this period.

Henry VIII. is infamous as bei first of our English sovereigns wh based the sterling fineness of our age; and, notwithstanding the n of checks upon it, history gives u most undeniable proofs how inef they all were, when the arbitrary w the sovereign was allowed to put la justice aside. Our admirable form regulations of the standard of the ness of money, have existed sinc reign of Edward III., but they we sufficient to prevent a Henry VIII. disgracing his reign, by perhaps the wanton debasement of the currenc was ever in a similar period of time tised in any country in the world. Wyon here adverted to a strange told of the workmen who were emp in melting the base coins (of Henry namely, that most of them fell

death with the savour, and that they were advised to drink from a dead man's skull for their cure. Accordingly a warrant was procured from the council to take off the heads from London-bridge, and to make cups of them, out of which they drank and found some relief, although most of them died. If there be any thing in this tale, it is probable that the sickness arose from the fumes of arsenic.

Henry VIII., on assuming the supremacy of the church, struck a medallic crown, to commemorate that very remarkable event; only one of these pieces is at present known, and is supposed to be of the highest value of any coin in the British series; the late possessor was offered 150*l.*, and refused; he estimated its value at 300*l.*

In the year 1529 Cardinal Wolsey was disgraced, and one of the articles of impeachment against him, was, that of having placed his hat on the coins. Henry VIII. was the first monarch who coined shillings for common circulation.

Edward VI. added the half-crown, sixpence, and three-pence; this is the last reign in which we find a farthing in silver, which had been current since the time of Edward I.

Elizabeth is celebrated in the annals of our coinage, for improving the standard of our currency. In order to hasten this improvement, and at the same time to show how much she was in earnest, she went publicly to the Tower, where she visited her mints, and coined certain pieces of gold, which she gave away to several about her. The restoration of the coinage to its former purity was celebrated by a medal being struck, commemorating that important event.

The only thing mentioned by Mr. Wyon, in reference to the coinage of James I. was, that the half unit, recording the Union with Scotland, has the following inscription, HENRICUS ROSAS, REGNA JACOBUS. Henry united the Roses, James the Kingdoms.

Charles I. in all his difficulties never debased his coins. Had he done so, the Parliament would not have failed to record the fact; he, however, preserved the standard inviolate, even when, from necessity, the workmanship of some was so rude, as to justify the suspicion that the dies must *have been* executed by a *common blacksmith*; the coins commonly called siege pieces, or money of necessity, were frequently mere masses of plate clipped off, and stamped with a castle, and various other rude devices.

One of the most important events in the history of our mint, was the invention of the mill and screw. Previous to the reign of Charles II., the money in circulation was made by forging or hammering slips of gold and silver to the proper degree of thickness, then cutting a square from the slip, which was afterwards rounded and adjusted to the weight of the money to be made; the blank pieces of money were then placed between two dies, having the device of the coin engraven upon them, and the upper die was struck with a hammer. This money was necessarily imperfect, from the difficulty of placing the two dies exactly over each other when the blank piece was between them, as well as from the impossibility of a man being able to strike with such force, as to make all parts of the impression equally perfect. The mill and screw, or, as we now term it, the coining press, was first invented in France, as is supposed, by Antoine Brucher, an engraver, in 1553, who first made trial of it in the palace of Henry II. It was introduced into this country by Nicolas Briot, from whose hand we have many patterns for coins during the reign of Charles I.; it was finally adopted at the Restoration.

We have also evidence of the mill and screw being used in the time of the Commonwealth, in a pattern for a coin, having on one side the English arms, with this inscription—"The Commonwealth of England," and on the other side two shields, upon one of which appears the English, and on the other the Irish arms, with this motto, "God with us;" there is milled round the edge, "Petrus Blondæus inventor fecit." These coins were the subject of standing jokes with the cavaliers. The double shield, on the reverse, was called the Breeches for the Rump; and from the legend, they took occasion to say that God and the Commonwealth were on different sides.

Mr. Wyon now directed attention to the admirable works of Thomas Simon, who executed the coins of the Protector. If (said he) we admit these coins to have been current money, they are the first which have an inscription round the edge.

His were also the first English coins with the laurel introduced upon the head. The portraits were modelled from the life by Simon, and are admirable for the truth of resemblance to individual nature; altogether, this series of coins presents to us some of the most beautiful specimens that are to be found on our coinage, combining, with the most exquisite workmanship, the mechanical advantages of the mill and screw.

Thomas Simon was chief engraver during the time of Cromwell, by whom he was much encouraged: he engraved the great seals, and many excellent medals, during the Protectorate, and remained in employment at the Mint during the early part of the reign of Charles II.; and, for the credit of our country, as it regards the coinage, it is to be lamented that Charles became discontented with this inimitable artist, sent for the family of the Roettiers, foreigners whom he met with abroad, (and who, it is said, assisted him with money during his exile,) and appointed one of them to Simon's place in the Mint. This stimulated Thomas Simon to execute his famous pattern, called the petition crown, which is thus described by Evelyn:—

"For the honour of our countrymen, I cannot here omit that ingenious trial of skill which a commendable emulation has produced in a medal, performed by one who, having been deservedly employed in the Mint at the Tower, was not willing to be supplanted by foreign competitors."

Upon the obverse of this pattern we have an excellent portrait of Charles; it is executed (for a modern coin) in high relief, and finished with great freedom and delicacy: on the reverse appear the arms of England, Scotland, and France, in four separate escutcheons, with the George in the centre; but, perhaps, the most interesting part of this piece is the inscription milled round the edge, running thus:—"Thomas Simon most humbly prays your Majesty to compare this, his trial piece, with the Dutch, and if more truly drawn and embossed, more gracefully ordered, and more accurately engraven, to relieve him."—There were but few of these pieces struck; the last that was offered at Sotheby's sale-rooms for public competition, and which was formerly in the possession of Mr. Trattle, sold for the sum of 225*l.*; so that posterity has done ample justice to the merits of the artist, although his skill, it is to be feared, failed of obtaining the redress which he sought. The Roettiers, though not equal to Simon, were certainly no mean artists; they continued in employment at the Mint until the time of William and Mary, when, on being suspected of a treasonable correspondence with the exiled king, they thought it advisable to quit the country.

The short and tempestuous reign of James II. could afford but little encouragement to the Arts, and the genius of William III. directed his attention to glory of a far different kind from that which is to be acquired from their advancement; but in the reign of Queen Anne we enter upon the second period remarkable for the beauty of our coinage. The dies were now executed by Croker, the chief engraver, and are justly considered to be only excelled by the masterly performances of Simon. It was during this reign that Dean Swift delivered to the Lord Treasurer his plan for improving the British coinage, which Mr. Wyon read and commended.

In consequence of Swift's suggestions, several patterns for halfpence and farthings were executed by Croker, in a style very creditable to him. One of the latter has Britannia under a triumphal arch holding an olive-branch in her hand; there is another on the Peace of Utrecht, with this legend—PAX . MISSA . PER . ORBEM. A third pattern has a female figure standing with an olive-branch in the right, and a spear in the left hand, signifying that she is desirous of peace, but prepared for war. The motto is BELLO . ET . PACE.*

After the time of Croker, the coinage continued in a very tolerable state, until the beginning of the reign of George III., when it fell into the most disgraceful condition, so that almost any thing in the least degree resembling silver was taken for a shilling or sixpence, without even the semblance of an impression, and even

* An absurd idea very generally prevails as to the value of a Queen Anne's farthing; it is thought, by the ignorant, to be worth many hundred pounds, and, in consequence, the officers of the British Museum are deluged with letters and applications on the subject: these supposed treasures generally prove to be mere counters; but granting they were genuine—and there are several varieties—the highest sum that has been given, for one in very fine condition, is about 5*l.*; they are generally of much less value.

this trash was so exceedingly scarce, that many persons were compelled to give a premium for it, to enable them to carry on their business.

In 1784, a copper token, called the Anglesea Penny, was struck by a private company, and from this time, the prerogative of the crown, as regards the coinage, seems almost to have ceased. Not less than 600 tons of copper were coined at Birmingham, into copper tokens, between the years 1787 and 1797, and we have not less than between four and five thousand varieties of this species of money, from various parts of the kingdom, remaining to attest the very peculiar state of the circulation. Many of these tokens exhibit fair specimens of art, in device and execution; they bear the portraits of illustrious men, represent historical events, views of remarkable buildings and great public works; and will hand down to posterity a general view of the state of architecture in Great Britain, in a cheap and imperishable form.

The silver coin followed in the steps of the copper, except that the Bank of England was, by authority, the first to issue silver tokens; this was done in 1797, by a countermark on the Spanish dollar. The bank also issued 3*s.* and 1*s.* 6*d.* tokens, but the price of silver advanced so much, as to cause this medium of exchange to disappear, and offered inducements to tradesmen to circulate tokens to an enormous amount. This disgraceful state of the currency continued until the year 1815. In the following year, the government resumed the prerogative of issuing money; since which time, the coinage is so familiar to us, as not to need any description.

MOULE'S ROMAN VILLAS.*

Much light has been thrown, since the discovery of the remains of Herculaneum and Pompeii, on the state of the arts, and the economy of domestic life, among the Romans. The author of the present work does not profess to have added, by actual research, to the already existing stock of information on these interesting points, but rather to have collected into one volume a concise and digested view of the facts which the industry of preceding investigators had gathered together, relating, more especially, to the country residences of the patricians of "the eternal city." He frankly acknowledges the extensive obligations he lies under to a number of recent writers, both at home and abroad, and to none more than M. Mazois, whose description of the house of a noble Roman, published at Paris in 1819, under the title of "The Palace of Scaurus," has supplied him with the greater part of his materials; although the numerous references in the notes to other works, sufficiently testify that Mr. Moule has bestowed considerable pains on the further illustration of the subject. The present volume, it appears, is to be looked upon merely as the commencement of a complete "History of Domestic Architecture," of which the next section (which we are led shortly to expect, should the present meet with due encouragement,) is to relate to the "Baronial Castles of England." Such a series, if well executed, would not be without its usefulness and interest.

The old Romans were no mean proficients in the art of building, either as regarded convenience or magnificence; although we are apt to imagine that there is considerable exaggeration in some of the highly coloured accounts which have descended to our times. With all allowances, however, we cannot read the description of Nero's imperial palace, without conceiving that its appearance must have been somewhat more splendid and imposing than that of St. James's:—

"Some idea of the extent and peculiar construction of the Golden House of Nero, is to be obtained from Suetonius's description. He states, that in nothing was the emperor more prodigal than in building; and that in this house the vestibule was lofty enough to admit under it a colossal statue of the founder, no less than one hundred and twenty feet in height, and that the palace extended, by three colonnades, a mile in length. In the centre was an immense lake, surrounded with buildings, having the appearance of a town; and within the compass of the domain were cornfields, vineyards, pastures, and woods, stocked with a variety of animals, both wild and tame. The interior of the palace was overlaid with gold, and enriched with jewels and mother-o'-pearl. The rooms devoted to public entertainments are represented as arched with

* An Essay on the Roman Villas of the Augustan Age, their Architectural Disposition and Enrichments; and on the Remains of Roman Domestic Edifices discovered in Great Britain. By Thomas Moule. London. Longman and Co. 8vo., pp. 172.

vaults of ivory, or with ceilings so contrived, as to scatter fragrant flowers among the guests; besides which, they were furnished with pipes, for conveying into different parts aromatic waters and sweet-smelling unctions. The chief banqueting-room in this palace is described as completely circular in plan, and fitted with a very ingenious piece of mechanism, made to revolve, producing the effect of day and night, in imitation of the celestial hemisphere. The baths, equally magnificent in their plan, were supplied with salt water from the Mediterranean, and with warm water, conducted by rivulets from the hot-springs of Baiæ. After an enormous expense had been thus lavished, and which nothing but the revenue of an empire could have afforded, Nero merely observed, he had at last completed a habitation fit for a man!"—p. 4.

Nor were the furniture and domestic utensils of the "masters of the world" unworthy of the mansions in which they were contained:—

"In the remote times of the Republic, there was so little even of silver in the city of Rome, that the senators mutually lent their plate whenever they gave an entertainment. 'The Romans, it appears, live upon a very familiar footing together,' once said the ambassadors from Carthage; 'we have been treated at all the great tables in Rome, and every where served upon the same silver.' But from the time that Scipio Africanus brought the spoils of Carthage and Numantia to the city, and after Lucius Scipio brought to Rome the treasures of Antiochus the Great, more gold and silver was to be seen on the table and in the dining-room of a patrician, than formerly could have been collected throughout the whole Republic.

"The Romans then strove to surpass one another in the beauty and elegance of the several pieces which composed a service of plate: the manufactures of superior taste, or articles of *vertu*, came in request; and at length the works of Acagres and Mys, both celebrated artisans in silver, were purchased at an enormous price, their names being sufficient to denote the superiority of the workmanship. Lucius Crassus, the celebrated orator, is recorded to have had in his possession silver vessels which cost him no less than a hundred and sixty-six crowns the pound; and a pair of beakers, for which he had paid above four thousand crowns, wrought by Mentor, an artificer who excelled in engraving flowers. At a later period, two vases, with figures in *relievo*, the workmanship of Zopirus, were sold for about five thousand crowns. In the amplitude of their vessels their taste was also shown: Drusillanus Rotundus, one of the retainers of the Emperor Claudius, ordered an immense dish to be cast for his use, which weighed five hundred pounds, and eight smaller ones of fifty pounds each: for the express manufacture of these expensive articles a workshop was erected.

"Cups and other vessels, when made of Corinthian brass, and executed by old masters of repute in their trade, were estimated at a higher rate than even gold. The collectors of these precious works of art became so refined in their taste, as to affect to be able to distinguish readily the age and genuineness of rare pieces, as well as the particular hand of the artisan whose workmanship they were professed to be."—p. 133.

It is rather singular that the now exploded fashion of decorating gardens, in which nature was forced to imitate art, rather than art made to take the appearance of nature, should be at least as old as the days of the Romans, notwithstanding the French have always had the *credit* of introducing it. The *hortus* of the Romans, we are told, was usually furnished with

"Marble seats, and a water-organ of simple and ingenious mechanism. These hydraulic organs are still very common in the gardens of Italy, which are generally laid out in formal taste; the Aldobrandini villa at Tivoli, presents an existing illustration of the description of an ancient Roman garden, and abounds, like its prototype, with avenues, clipped hedges, basins, fountains, cascades, caverns, and a water-organ; here a hundred tricks are played off by means of concealed streamlets suddenly sprinkling the visitors. Statues of illustrious men were by no means an unusual ornament of the Roman gardens, as well as the marble Hemicycle, or semicircular seat."—p. 103.

So that "the French taste" was evidently, in all respects, merely a counterpart of the old Roman.

THE LONDON MECHANICS' INSTITUTION—TENTH ANNIVERSARY.

The tenth anniversary of this institution was celebrated on Thursday last, at the theatre in Southampton-buildings.

Dr. Birkbeck, in opening the proceedings, stated that, some years ago, "there were in the neighbourhood of London not less than six institutions of a kind similar to theirs, but that these smaller ones had disappeared, and in their stead others in different places had sprung up." The Doctor should have stated frankly the real state of the case, which is this—that the "six institutions"—which were

Mechanics' institutions in the strict sense of the phrase—have become extinct, while the "others" which have sprung up in their "stead" are general literary and scientific institutions, which have no more connexion with mechanics than with any other class of the community.

Dr. Birkbeck further observed, that "last year had witnessed the formation of several (Mechanics' institutions) in towns of great importance, under the most gratifying circumstances. Institutions had been formed in Leicester, Salisbury, and Lincoln. The Lincoln institution had concentrated more influence, and more general power, than had ever attended the formation of one institution. He had great pleasure in informing them that one of the gentlemen connected with that institution was then within their walls, the Hon. Mr. Pelham, whose father, Lord Yarborough, had also taken a lively interest in it. The Lincoln institution contained 500 members, who had admitted among their lectures all branches of moral philosophy, but had excluded those subjects which they themselves had also found it necessary to exclude."

The increase of such institutions throughout the country is undoubtedly a very gratifying circumstance, and the particular commendation bestowed on that of Lincoln extremely well merited. Its patron, Lord Yarborough, has been long known to us as being not only an ardent friend of scientific pursuits, but himself a most expert and ingenious *mechanic.*

The Hon. Mr. Pelham, alluded to in the President's address, moved the first resolution, which was to the following effect:—

"That for ten years from its establishment, the steady afflux of more than one thousand members, to participate in the advantages held forth by the London Mechanics' Institution, is an irrefragable proof that the want of that information which it was founded to diffuse, was and is widely felt, and continues to be efficiently supplied."

The London Mechanics' Institution was founded (*we* ought to know) to diffuse scientific information among *working mechanics;* and if the "one thousand members," whose steady afflux is here boasted of, had been of the class of *working mechanics*, the proof would have been *indeed most "irrefragable;"* that the want of such information has been "widely felt" among them; and that the institution is a place where it can be "efficiently supplied." But, how stands the fact? Originally a large majority of the institution, certainly more than two-thirds, were working mechanics; but now the majority is all the other way—not one-sixth of the thousand are working mechanics. The Institution is in fact no longer a *Mechanics'* Institution, except in name. The resolution, therefore, affirms what is directly contrary to the truth; and those who concocted it, and placed it in the hands of the honourable mover, knew this full well.

Mr. Pelham "thought the institution at Lincoln would have a better chance of getting on, if it had some institution longer founded to look to, and why should not the London Mechanics' Institution be the one to which they should apply for any information wanted?"

Why not, indeed? It was meant to have been, ought to have been, and might have been, a model for all similar institutions throughout the country; but, as it is, what is there to copy?

Mr. Babbage moved the second resolution, which was as follows:—"That the constancy of adherence of a great number of the earliest members of the Institution shows, that its capacity to instruct grows with the growing intelligence and improving culture of those who seek arts and science and knowledge within its schools; that it does not offer the meagre and quickly exhausted routine of the long founded seminaries of a contracted scheme of elementary education, but it possesses and presents the means of acquiring knowledge, copious, profound, and varied, having the power of hourly adaptation of its resources to the varying character and growing demands of the claimants on its aid."

We wonder that a gentleman of Mr. Babbage's cautious and accurate habits, should have been persuaded to lend his countenance to such empty stuff as this. We are quite sure he could have made no inquiry into the number of "earliest members of the institution," who still adhere to it, when he described it as a "great" number; and as to the "constancy of adherence," he is too good a logician not to perceive that it proves

nothing whatever as to the quality of the instruction afforded by the institution, unless it could be also shown (which it cannot) that they continued to attend the lectures as regularly as they continued to pay their subscriptions. Great praise is claimed for the institution, because it does not offer "the meagre and quickly-exhausted routine of the long-founded seminaries of a contracted scheme of elementary education," that is, of Oxford and Cambridge; but what would Mr. Babbage say to a seminary without any "scheme" at all; where the course of instruction is entirely a matter of chance; where it may be either good or bad, just as accident may determine; where it is an even chance whether a mechanic shall be instructed in the sciences, or in the *belles lettres*—taught to follow the steps of James Watt, or to mimic John Reeve? Should Mr. Babbage be desirous of seeing such an institution in full operation, he has only to ask for a return of the lectures delivered at the London Mechanics' Institution, since (almost) its very commencement.

Colonel Torrens moved the third resolution which was in these terms:—"That the manifestation of talent developed within the walls of the London Mechanics' Institution, shown on the present as on former similar occasions, is a gratifying proof of the wisdom of the plan here first widely called into practice, of disseminating useful science through the industrious classes of the community; and gives substantial earnest that through the agency of these self-ruled and self-supported establishments, the barbarism of ignorance, with its concomitants vice and misery, will be more rapidly dispelled; and the moral, the intellectual, and the social condition of man be raised to that higher level which alone becomes his character as a rational and responsible being."

"Self-ruled and self-supported"! Alas! alas! How in this instance is the *self-support* attested? By many thousand pounds of donations from persons of rank and affluence, (some of them bestowed from the merest politico-electioneering purposes)—by *gratuitous* lectures from every one who had a morsel of instruction or amusement to confer on the *self-supported* association—and by a load of debt under which the institution (if left to itself) would sink into the dust. And the *self-ruling*—how is it proved? Is it by the chief creditor being the chief ruler?

Col. Torrens, in enforcing the resolution intrusted to his charge, dwelt largely and eloquently on the rising influence of knowledge. But of all knowledge, he thought "that of political economy was the most useful." Nothing like leather.

Dr. Lardner moved as a fourth resolution:—

"That the thanks of the meeting are eminently due, and are hereby warmly given to all those enlightened and liberal men, who nurtured this institution in its infant weakness, and who still give aid to its growing strength."

The "infant" state of this institution was *not* one of "weakness," but of strength; it is as it has grown old, that it has grown weaker and weaker. A return of the number of members belonging to the institution, for each year since its establishment, and distinguishing those who are mechanics from those who are not, would prove this incontestably. We have often called for such a return, but in vain. The creditor-director of the institution knows well that it would prove every thing we have asserted on the subject, and therefore it is that it continues to be most pertinaciously withheld.

NOTES ON MR. NUTT'S WORK ON BEES.

Sir,—Since I addressed you on the subject of bees, and Mr. Nutt's system of managing those insects, I have procured his book, and have made a few remarks on it; in doing which, if I have differed in any point from those made by yourself, I trust your candour will induce you to pardon me, particularly as you state you are no bee-master. I profess to be one, and will stick to *my* order.

Before, however, proceeding with these remarks, I cannot help noticing the very frequent allusion Mr. Nutt unnecessarily makes to the Deity, which, to say the least of it, shows very bad taste. The following passage seems to me particularly objectionable: — "He that has trampled upon my humane endeavours, and disdained my predictions relative to this subject, will be taught to tremble before Him who gave the light to such an humble individual as myself"! As a clergyman wrote part of the book, and arranged the whole for publication, and

four other clergymen received subscriptions for it, I am struck with astonishment that they should have allowed such a passage to see the light.

The author in dedicating his book to the Queen, only follows the example of a former writer on bees, whom I knew well (Mr. Wildman), who, about seventy years ago, dedicated his work to the mother of his present Majesty.

In the preface to the book, Mr. Nutt states that, in consequence of a very severe illness in the year 1822, which deprived him of the power of attending to business, and while passing his idle hours in his garden, his bees *caught* his attention, and he *became* fond of them. We are farther informed, that, *after some years'* unremitted attention to his bees, an accident directed his attention to the effects of ventilation, and that this gradually led to the development of his improved mode of management. The accident alluded to, appears to have been that his bees clustering under their hive, for a length of time, formed combs. A common chopstick, instead of ascribing this to an accident, would have thought himself deserving of a good whipping, if he allowed his bees to remain in such a state a moment after he found there was no chance of their swarming.

To return, however, to the origin of Mr. Nutt's system—although the first idea of it is stated to have occurred *some years after* the sickness of 1822, yet, according to the pages of the Mech. Mag., vol. xv. page 254, the matchless hive, with its collateral boxes, octagon, ventilators, thermometers, &c., was in full operation in the year 1823, having contributed in August (that year) 28 lbs. of honey, and 127 lbs. being left in the autumn for the support of the bees during the ensuing winter. Is there not some inconsistency here?

In his fourth chapter the author has favoured his readers with a dialogue, which he states took place between himself and a learned lord at the National Repository. It is to be hoped Mr. Nutt will be kind enough to allow his readers to form their own opinion respecting the profundity of his lordship's learning. The conversation commences by his lordship communicating to Mr. Nutt that he has six cottage-hives of bees on his estate, which he wishes to put upon his principle of management, and desires to be informed how to accomplish the desired object? Mr. Nutt very cautiously says —"My Lord, much depends on the state of your hives. Are they rich? Will the six hives make three good colonies?" His lordship, with great candour, immediately replies, "I do not know;" but asks, "if three are rich, and three poor, which would you advise me to establish on my estate?" Mr. Nutt replies, "The three rich ones; for, by uniting the bees of a healthy hive with those of a light one, the light one being already incapable of supporting its own population, many persons have failed of success. In fact," he elegantly adds, "it is an *unhappy*, i. e. a *wrong move*." The very next time, however, Mr. Nutt opens his mouth, he gives this oracular dictum of his the most flat contradiction. "Your lordship's three rich hives," he says, "will receive the numerous bees of the three weak ones; and they will, *notwithstanding such additions to their numbers be in a state of prosperity, and* ALL *your bees be in the greatest safety*." It is an "unhappy—a wrong move," and yet produces the best possible results! His lordship next puts the following question to Mr. Nutt—"Do the bees remain in a complete state of torpor, or lethargy, during the winter, as we are told they do by some ancient authors?" It is to be regretted that the learned lord did not condescend to mention the names of these "ancient authors." Mr. Nutt replies, rather dogmatically—"They do, my lord, no doubt, if the bees are placed in proper winter quarters." This is likely enough to be the case, if "proper winter quarters" here are the same as in Germany; for there, Mr. Huish informs us, they *bury* them during winter; otherwise what Mr. Nutt asserts so positively is irreconcilcable with the facts on the subject mentioned by Mr. Huish, who states that, during the very severe winter of 1814, he exposed in the open air a *glass* hive, full of bees, into which he had inserted a thermometer, and that he placed a similar thermometer in the open air, by the side of it, which fell to 20 degrees below freezing, whilst that in the glass hive was at 20 degrees *above* freezing—making a difference of 40 degrees; and the bees, instead of being in a state of torpor or lethargy, continued very lively. Mr. Huish adds, that this incontestably proves that bees

are *not* in a state of torpor during winter. Huber was also of the same opinion. If it really be the opinion of Mr. Nutt that bees are in a state of torpor during winter, why did he lead the readers of your Magazine to believe that one hive of his bees consumed the prodigious quantity of 712 lb. of honey in the winters of six years?—(Mech. Mag., vol. xv. p. 254.) I do not approve of moving bees in winter from their usual situation, but prefer putting up a temporary shade, to screen them from the sun in frosty weather, for if mild weather occurs in winter, the bees are induced to leave their hives, which is conducive to their health, and if the situation of the hive has been changed, they are not able to find their way home again, and many of them perish. Neither do I approve of shutting them up in winter, as recommended by Mr. Nutt. Mr. Huish, however, mentions in his book that people, in some parts of England, from religious prejudices, *shut* up their bees on Wednesdays and Fridays, to prevent their going to their labours!

Mr. Nutt is next asked how much honey and wax he had ever in one year taken from *one* of his hives? The apiarian replies—" I have taken 296 lb. of honey, inclusive of wax, during the honey harvest of 1826." Now, in your Magazine, Mr. Nutt stated, that he took that quantity of honey, but was entirely silent respecting the " wax inclusive;" by which omission he deceived many of your readers—amongst others, myself. It appeared to me a most incredible quantity, and still does, even now that the wax is included.

His lordship proceeds to ask Mr. Nutt, if he had " ever proved Shirach's discovery satisfactorily to his own mind?" " I have, my Lord," says Mr. Nutt, " and acknowledge it to be one of the grandest discoveries, and of the utmost importance to the skilful apiarian; for this *move* alone (this elegant expression again) prevents the necessity of swarming." Mr. Nutt has repeatedly asserted, that from books he never should have made one useful discovery; and yet he here admits this of Shirach's to be " one of the grandest ever made!" How is this?—Did he make it himself, without the aid of books? Neither the learned lord nor the *skilful apiarian condescend* to mention *what this grand " move"* of Shirach's, which supersedes the necessity of swarming, is; both are as cautious and silent as the two kings of Brentford in the " Rehearsal:" but I will, for the information of your readers, mention in what it consists. It is, that bees, when deprived of their queen, have the power of selecting some of the larvæ of what would be working bees, and converting them into queens; to effect which each of such larvæ has a cell formed for it, like those of the queen bees, and is fed with similar food to that which is given queens in their larvæ state—by which treatment, instead of becoming common working bees, they become real queens. This appears to me about as probable as that the bird hatched from the egg of the cuckoo, laid in the hedge-sparrow's nest, should, by being fed with the same kind of food as the hedge-sparrow feeds her own young, become a hedge-sparrow. But, even supposing it to be consistent with truth, how can this " move"—to use Mr. Nutt's elegant phraseology—prevent the necessity of swarming?

The remainder of his lordship's questions are so puerile, and the replies of the great apiarian so egotistical, that they absolutely are not worth making a remark on. I proceed, therefore, to notice the next chapter, in which the subject of winter quarters for bees is very unnecessarily resumed. The author says his observations have reference to bees kept, as the learned lord keeps his, in straw hives, rather than in boxes—from which it may be presumed that bees kept in boxes require no removal from their summer situation. Now, I have kept bees in straw hives a great length of time, at least quadruple that which Mr. Nutt has, and no apiarians with whom I have been acquainted ever move their bees in winter. Neither have I ever done it, but have followed the advice of Mr. Butler in his " Feminine Monarchie," who says, " in no wise let the place be shadowed from the south sunne; for that doth not only dry the hives, and relieve the bees in winter and spring, but also causeth them to swarm in summer." Mr. John Hunter, a name not totally unknown, and whose reputation will probably endure as long as Mr. Nutt's, says 18 lb. of honey are amply sufficient to maintain a strong hive during the whole winter, and until June, if necessary. It therefore struck me with astonishment to

read the following account given by Mr. Nutt. In the year 1824, he had six straw hives, three of which he placed in proper winter quarters on the north side of his house; in November, one had 42 lb. of honey, another 37 lb., and the third 32 lb. On the 26th of March following, they were again weighed; and, as a matter of course, the result triumphantly confirms Mr. Nutt's hypothesis, for they had only consumed 5 lb. of honey each, being just 1 lb. per month, and all swarmed in the May following. Then followed an account of the three hives left in their summer situation. They were heavier in November than the three whose fate has been already noticed; one had 40 lb. of honey, another 38 lb., and the other 35 lb.: on the 26th of March following, these hives also underwent the ordeal of weighing; and although the others had consumed only 5 lb. each, these prodigals had wasted in riotous living, no less than 21 lb. each! or upwards of 5 lb. per month; one of them too never swarmed the next summer, and the two others not until July. By the account given, each of these hives had remaining on the 26th of March, more honey than such an authority as Mr. John Hunter says is amply sufficient to maintain a hive of bees the whole winter, and every keeper of bees will accede to his opinion. Something must have happened to these three hives which is not mentioned, or there must have been a great error in weighing them. Mr. Nutt very significantly observes, "I need scarcely relate, that the bees placed fronting the North were the first that swarmed." Certainly, it was unnecessary to relate this, for the result, however wonderful, could easily be anticipated.

Having finished this remarkable chapter I go to the next, which is commenced by asserting, that the hives invented by Huber and Dunbar are failures. This assertion is positively untrue; they were both intended as experimental hives, and have both answered that purpose admirably. It is natural that Mr. Nutt should be anxious as a tradesman to recommend his own hive, but it creates astonishment that he should venture to make an assertion so contrary to the truth. He says that the piling of hive upon hive, or box upon box, called storyfying, has also failed. *Now, whatever Mr.* Nutt may say respecting storyfying, or as he in derision calls it, piling hive upon hive, it was thought differently of in the year 1675, when introduced by Mr. John Giddie, who had a patent for it, as the Royal Society of that time highly approved of it, and thought it worthy of their recommendation. ("Philosophical Transactions," No. 96.)

I now propose making some remarks on the matchless hive, which the student of the Horncastle Grammar School designates his *Terra Incognita.* This appellation may suit learned lords, but when I was eight years of age, if I had called a deal-box a *terra incognita* in my master's hearing, a good cane would not have been many minutes' *incognita* to my back. I have read Mr. Nutt's description of the hive many times over, but confess its merits are still *incognita* to my understanding; I have carefully examined the three wood-cuts representing it, and cannot discern a door-way in either. Neither is there in the whole book the least mention made of one; such a thing is usual in straw hives. In p. 25, the author says, "the plates here presented to my readers, exhibit a set of my collateral bee-boxes open, and every compartment exposed to view, especially to the view and for the examination of experienced workmen;" I defy, however, any workman, let him be ever so experienced, to make a hive to possess the merits Mr. Nutt states his to have, from this or any of the cuts or descriptions he has given. He says there has been some difference of opinion as to the most suitable dimensions for bee-boxes; "I approve and recommend," he adds, "those which are from eleven to twelve inches square inside, and nine inches deep." But he is particularly careful to avoid saying, *I use* boxes of those dimensions. He then very slightly mentions what is of great importance, the communication between the centre box and the two side ones, but leaves the nature of it to be gathered from the wood-cut, and entirely omits to mention how the tin dividers are inserted: no mention is made of either the width or length of them, nor does he state whether they move in a groove. If the communication between the boxes is made in the way shown in the cut, numbers of bees must inevitably be destroyed, for every bee passing from one

box to the other at the time the dividers are inserted, must be killed, and probably hundreds may be doing so at the same time.

There is a description indeed given of the communication between the central box and the glass, but it is not mentioned whether there is any framework in the boxes for the bees to support their combs, a thing particularly described by Geddie and Thorley.

In describing the framework for the tin ventilators, we are told it must be four inches square. But why should the aperture be so large, when the ventilator is only one inch in diameter? After all the fuss too about thermometers, there is no mention made in this chapter, nor in any part of the book, where they should be inserted into the hive; the "experienced" workman is left to guess where and how. Although the light has been imparted to Mr. Nutt himself, he takes especial good care it shall not shine on others. In short, instead of giving a description of his hive which might be intelligible, he wastes all his time in describing three drawers placed underneath it, one for the purpose of feeding the bees,—but what egregious folly to talk of feeding bees that collect 127 lb. of honey for their own support during one winter? The two other drawers are to let the bees out of the boxes intended to be taken, and the way for them to make their exit by is to be cut in a "semi-lunar" shape. The author omits, however, to say whether it is half the moon in her increase, or when at the full. Altogether, Mr. Nutt has contrived so to mystify the description of his hive, that no person in the world (excepting his noble friend, perhaps) can understand it.

We come next to its uses and merits. Having been conversant with bees quadruple the time Mr. Nutt has, I must express my disbelief that he ever obtained in one year honey and wax weighing 296 lb., besides leaving 109 lb. of honey for the consumption of the bees in winter; in fact, no reflecting person can for a moment credit it. This quantity of honey will fill upwards of twenty-nine imperial gallons. Mr. Nutt says he has frequently taken a box weighing 60 lb., and in one instance, he asserts, he took a box with 65 lb. of honey. Now, if he use boxes of the dimensions he says he *approves of and recommends*, namely, twelve inches square and nine inches deep, I unhesitatingly assert that he never has done any such thing, for the cubic contents of such a box will only hold 63 lb. 12 oz. of liquid honey; I have made no deduction for the space occupied by the ventilators and thermometers; but as bees have always a great space between every comb, and there are passages also in the combs, Mr. Nutt's box will not hold, I am perfectly convinced, more than 30 lb. of honey-combs as the bees place them. My straw hives, which hold upwards of 500 cubic inches more than Mr. Nutt's boxes, have never yielded me more than 30 lb. of honey at one time; and the Rev. Mr. Clark, who says his hive was given him by Mr. Nutt, and which of course would be of the same size as those used by him, mentions, that a *full* box of his had only 35 lb. Here we approximate to the truth, and it ought to make Mr. Nutt blush. I am convinced Mr. Nutt's three boxes together will not hold any thing like 127 lb. of honey, which he asserts he left for their support during the winter; if they will hold half the quantity, it is as much as they possibly can.

As far as I can understand, the bees, in winter, are confined to the centre box, and are not allowed to enter the side ones until summer, when they are directed to be rubbed with honey. It appears rather curious to a person on whom the light has never shone, that, after all the eulogiums Mr. Nutt has passed on his side boxes, the bees will not go into them without a little coaxing. Mr. Nutt's *beloved* bees, as he calls them, seem to be not so grateful as they ought, for what he, rather irreverently says, the finger of Providence led him to supply them with, namely, fresh air; for they are actually so wicked as to stop up his ventilators with propolis. There is a circumstance which Mr. Nutt omits to mention (no doubt from forgetfulness), which is, that although a child of twelve years old can easily take a glass off the centre box of his hive, which is exactly the same thing as taking a box off a storied hive, he cannot *himself*, without great difficulty, take a box away from his own hive. The omission, however, is kindly made up by the Rev. Mr. Clark, his most improved apiarian pupil, who mentions that Mr. Nutt, in taking a box away from his hive, which was a present

from Mr. Nutt, took the queen bee also, and in putting her back to the hive, Mr. Clark was stung. The rev. gentleman, who, Mr. Nutt says, bids fair to become an ornament to apiarian science, also mentions that his bees swarmed. Neither of these facts would probably have seen the light, had it not been for the communicative disposition of the rev. gentleman; and such a thing occurring in these matchless hives, is a positive proof that Mr. Nutt's theory of bees swarming from necessity, not choice, is erroneous. The author gives directions how to act when such an event occurs,—a proof of its frequently happening. "Let the swarm," he says, "be put in one of my collateral boxes, making a door for the egress of the bees, and stop the communication between it and the centre box. When the bees have filled the box with combs, then stop up the door, and allow the communication between the two boxes, and the bees will unite and become one family." I deny that they will do any such thing without fighting; and the assertion should suffice to convince any person acquainted with bees, that Mr. Nutt knows but little of the subject on which he writes. It also appears that Mr. Nutt's favourite hive of bees swarmed; but that it was in consequence of his suffering them to do so. Does not this of necessity imply that they swarmed from choice? "It was," says Mr. Nutt, "the finest swarm I ever beheld, and literally *darkened* the air in the front of my apiary." I have seen hundreds of swarms, but never such an one as darkened the air. "I immediately," he adds, "secured my *grand prize*." A swarm called a grand prize, and by one who contends that swarming is an evil! He did not, however, secure his grand prize by putting it into a hive, as I should have done, but only put a sheet before it. My bees, with such treatment, would have fled away, and not considered themselves secured.

Mr. Nutt says that when the thermometer stands at 130 degrees in a hive, the bees are in their greatest prosperity. Huber, who is allowed some credit for being accurate, says, that when the thermometer is at 104 degrees, the heat is intolerable to the bees.

My remarks having extended to a much greater length than I at first had an idea of, I must postpone what I have to observe further on this remarkable book to a future opportunity, when I shall, with your permission, resume them, and likewise examine Mr. Nutt's pretensions to entomological knowledge.

I remain, with respect,

Sir, your very obedient servant,

J. P. T.

A HINT FOR THE FURTHER PROTECTION OF THE PUBLIC AGAINST CARELESS CAB AND HACKNEY-COACH DRIVERS.

Sir,—As I was passing, the other evening, along Kingsland-road, a cab drove furiously along, when one of the wheels came in contact with a poor old female who was crossing the road, and knocked her down. I immediately ran to pick her up; but instead of the rascal of a driver stopping to assist me, or to ascertain to what extent the unfortunate woman might be injured, he gave his horse an additional cut or two, and speedily drove out of sight. The evening was unluckily too dark to admit of my taking his number. It so happened that the old lady, though much shaken, was not seriously injured; but that does not lessen the intentional enormity of the fellow's conduct. Now, as these public desperadoes are compelled to have their numbers fixed in the centre of the back part of their vehicles, I think it would be a great improvement if these numbers were ordered to be painted on glass, and lighted up at night by a small lamp placed behind, so that in the event of a repetition of such behaviour as that I have described, persons might be enabled, even in the darkest night, to note down with ease the number of the delinquent.

I am, &c.

ENORT.

Marlboro'-terrace, Albany-road.

NOTES AND NOTICES.

In the Philadelphia Museum there is an artificial magnet, consisting of fifteen bars, which weighs no less than 53 lbs., and required, on the first trial, 310 lbs. weight to overcome the attractive force. Its permanent force is 134 lbs., and it constantly supports a weight of 84 lbs.

New Comet.—Professor Schumacher, Astronomer-royal of Denmark, announces, in his *Astronomische Nachrichten*, of the 7th inst., the discovery of a new comet, on the 8th ult, by Professor Gambart, of the Marseilles Observatory. Although it disappeared on the 13th, and from the state of the weather, and the temporary imperfection of his micrometer, his observations were interrupted and imperfect, Professor Gambart assigns its

place, on the 10th, at 16 h. 32 m. 45 s. of sidereal time, to be 20 h. 9 m. 7 s. of right ascension, and 22 deg. 33 m. of south declination. When first seen it was near the horizon, having a nebulous appearance, and situated in the constellation Sagittarius, very near the nebulæ 2064 of Sir John Herschell. The comet was of a pale light colour, of a very round form, and of a diameter of about four or five minutes.—*Athenæum.*

It appears from the American journals, in which a keen contest is carrying on respecting the originality of Burden's twin steam-raft, that the celebrated Robert Fulton built for the United States Government a steam-frigate called "Fulton the First," which was "split into equal parts longitudinally, from stem to stern, down through the keel, and the two halves placed at a distance from each other in parallel lines, and joined above water by timbers and decks in the most substantial manner;" and that, about the same time, a boat was built on a similar plan, called the "Happy Couple," but "that not answering the expectations of the projector, the Couple were cut asunder, the beams shortened, and the two halves fastened together by the keels, stems, &c., and thus made a single boat." We must observe, however, that it is not so much the division of the boat or raft into two parts, which constitutes the novelty of Mr. Burden's invention (for there have been many boats on that plan besides those mentioned in the American journals), as the conical or barrel shape of the spindles, and their being made hollow. The only person who can fairly contest the originality of that feature of the invention, seems to be our own correspondent, Mr. Alfred Canning.

The Influence of Steam.—The *Carnarvon Herald* states that the Welsh farmers have begun to send cattle to the Liverpool market, and that a sharp competition is likely to arise between them and the Irish graziers, for the honour and profit of feeding the people of Lancashire. The first cargo of Anglesea or Carnarvon fat cattle was sent by Sir R. B. W. Bulkeley, and several others have been since dispatched from the neighbourhood of the Menai Bridge. We are only surprised that Anglesea cattle have been so long in reaching Liverpool, considering that hundreds arrive every week from all parts of Ireland, together with sheep and pigs innumerable. The Scotch Highlanders have begun to send their live stock to Liverpool. A large flock of sheep arrived from Sutherlandshire the other day, and is probably by this time transferred into mutton. This is a new triumph of steam, to bring food for the people of Lancashire from so near the Ultima Thule; but all the coasts of the three kingdoms, and all those parts of the interior which are accessible by water, must in a few years become grazing farms for the manufacturing districts, to the great advantage both of producers and consumers.—*Liverpool Chronicle.*

A correspondent of the *Times*, who sighs most plaintively for distinctions for men of science—distinctions other than their science procures for them, and such as they would share with the lowest creatures of the court—shows the low quality of the thing he desires, by the commonplace notice he so immoderately extols. We regret that so respectable and distinguished a man as Dr. Dalton should be made the subject of such flummery.—"During Dr. Dalton's visit to London, it was thought by his friends that it would be proper (if not inconsistent with his private feelings) that he should be presented to his Majesty; and in that case, that the robes to which his academic degree entitled him would be the fittest costume for him at the levee. The Lord Chancellor being made acquainted with these feelings, not only immediately approved of them, but most kindly *offered to present Dr. Dalton* to the King. Dr. *Dalton having been made acquainted* with the usual *forms, agreed to the propriety* of the view taken by his friends, and attended the levee. The King received the philosopher very graciously, and very kindly relieved the little embarrassments of an unusual position, by addressing to him several questions respecting the interests of the town of Manchester. This condescending attention on the part of his Majesty will, no doubt, be equally gratifying to the learned body to which Dr. Dalton belongs—to the intelligent society of which he is a member, and to the enlightened manufacturers of his native town."—*Times*, May 15.—All this is very kind and considerate on the part of the King, but it confers no distinction, as a hundred persons of ordinary or questionable pretensions have received as large a portion of the Royal notice. Is science exalted by this wonderment that the King can be courteous and kind to a man of science? Either science is degraded, or kings are satirised by the excessive importance thus attached to a little usual civility, which would not have called forth a remark if it had been shown to one a thousand degrees less worthy of it.—*Examiner.*

Those who have travelled by the Paisley canal in the new gig-boats, must have observed the swell of water *which always accompanies or precedes the vessel.* Sometimes a curious scene occurs from this wave, overtaking some hapless wight standing on the bank, ignorant of his danger. The other day a commercial Irishman, who had collected from many an obscure corner a stock of old boots and shoes for exportation, was busy at the Blackhall bridge, washing off the dirt to make them more marketable. Being quite intent on the work of purification, he did not, till it was too late, observe the boat coming forward. His stock in trade was neatly arranged on the pathway, when the wave came up and swept the whole into the water. The poor fellow first rubbed his eyes, to make himself sure he was not asleep; and after gazing a little, and being persuaded it was a fact, he made up his mind to bear the loss calmly, and, with Paddy's characteristic recklessness and good humour, exclaimed, "Well, to be sure, I wanted to wash them clane, and troth they're washed clane off."—*Greenock Advertiser.* This is the canal where, according to Mr. Grahame, the *candid* partisan of canals in opposition to railways, the quick passage-boats never raise even "a *ripple on the banks*"!

Colonel Macerone is again figuring away in the newspapers—performing every day some new miracle with his steam-carriage, but, as usual, ever and anon quarrelling with the gentlemen of the broad-sheet, for not puffing his performances sufficiently. He finds great fault with them for saying that in a late excursion he went at the rate of only eighteen miles an hour, and maintains that "it was undoubtedly at the pace of *twenty five* miles an hour." He is making, it is said, active preparations to put ten of his steamers on the Brighton road, which are to run at the rate of fourteen miles an hour, inclusive of all stoppages. This he *guarantees*; money is only wanting to prove him no boaster. We wonder he does not guarantee, into the bargain, that his ten fire-eaters shall run 17,000 miles without costing more than a shilling each for repairs. Sure-*ly* the one pledge might be as easily redeemed as the other.

Communications received from Mr. Inglis—Mr. Woodhouse—Mr. Weekes—T. W.

The Supplement to Vol. XX., with a Portrait of William Symington, is now ready, price 6*d.* also Vol. XX., complete, in boards, price 8*s.*

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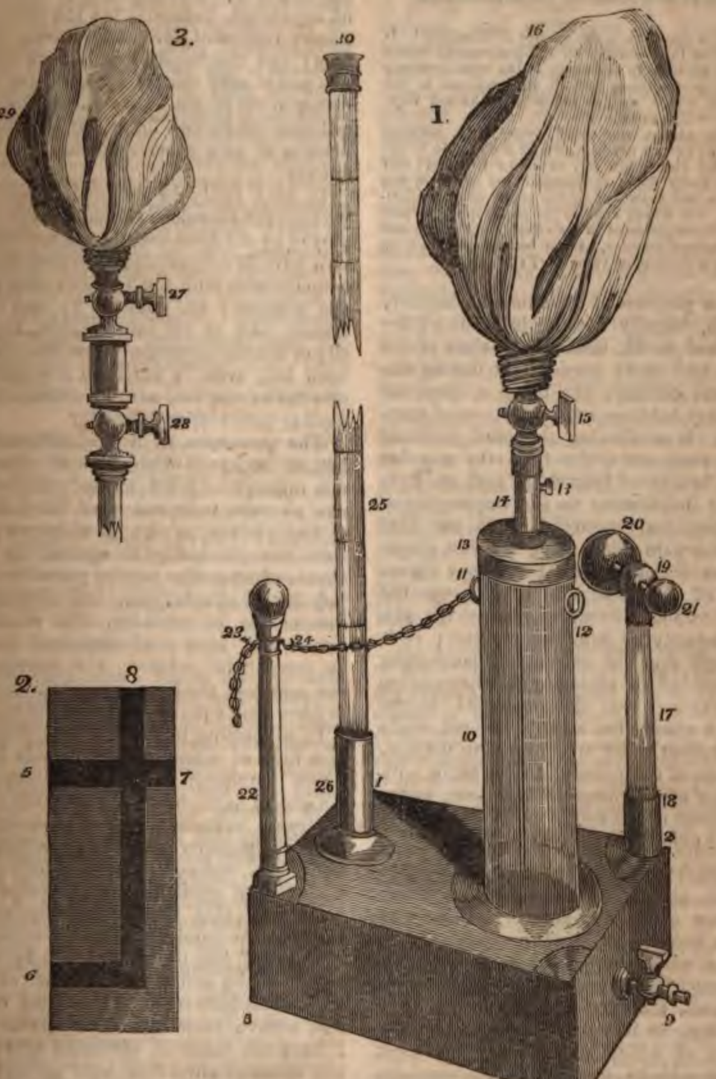
WEEKES'S UNIVERSAL PORTABLE EUDIOMETER.



MEMOIR, DESCRIPTIVE OF AN UNIVERSAL PORTABLE EUDIOMETER, ITS CONSTRUCTION, AND MODES OF USE. By W. H. Weekes, Esq., Surgeon, Lecturer on Chemistry and Experimental Science to the Canterbury Philosophical and Literary Institution, &c.

"How immense is the empire of chemistry! It embraces in its studies all the phenomena which nature presents to our view, in the infinite variety of her productions, and all the processes of the arts for which we are indebted to human ingenuity."—CHAPTAL.

"The person who could devise only, without knowing how to perform, would not be able to extend his knowledge far, or make it useful; and where every doubt or question that arises in the mind is best answered by the result of an experiment, that which enables the philosopher to perform the experiment in the simplest, quickest, and most correct manner, cannot but be esteemed by him as of the utmost value."—FARADAY.

The progress of experimental inquiry, which, happily for the interests of the civilised world, towards the close of the last, and more particularly during the present century, has taken a deep and salutary hold upon the affections of mankind, is awakening the most dormant and energetic spirits from the slumber of a benighted ignorance, and an apathetic indifference to the importance of philosophical research. It is not here necessary to dilate upon the vast acquisitions obtained from this happy extension of the powers of mind, over the multitudinous forms of matter, through the agency of practical inquiry; it is enough that the genuine philanthropist is enabled to glance with retrospective satisfaction over the beneficial results which science has already effected, while his ardent mind brightens with the operations of the present, and expands with the joy of a generous enthusiasm, as the prospects of the future unfold themselves to the eye of intellectuality.

Amidst the splendid scenery with which philosophy has decorated man's theatre of action, none, perhaps, has been arrayed in brighter vestments, or shone with a more resplendent lustre, reflected from a thousand arts and manufactures, than the science of chemistry; holding, as it does, a talisman, the potency of which unlocks nature's most secret cabinets, and from thence displays, alike to the philosopher and the artisan, *the hidden properties* of the whole material world.

This science is, of necessity, when it arrives at legitimate conclusions, wholly experimental; and as a constant succession of new facts are created by experiment, the occasion arises for modifying and extending operative power. Hence the advantage and convenience of simplifying and improving the varied forms of apparatus, necessary for the multifarious purposes of the philosophical chemist; and the importance of increasing his power over matter by a skilful addition to his means of subduing and regulating its various forms, by the introduction of new species of instrumental agency.

It may justly be doubted, whether, without the enormous voltaic battery employed by the illustrious Davy, we should now have to congratulate ourselves on an acquaintance with the metallic basis of the alkalies; or, unaided by the immense, and as yet incalculable, intensity of the oxy-hydrogen blow-pipe, have been led, even to entertain a suspicion that the earths, too, are but oxides of a similar modification of matter.

The possession of a new instrument, has, in the hands of the man of science, not unfrequently led to the creation of new pursuits, independent of the facility it has yielded to the development of facts not previously recognised in the annals of scientific inquiry; and to the importance of enlarging, and advancing the means of research, the eminent names that have shed abundant lustre on continental science, and especially the *savans* of the French capital, appear to have been equally alive with ourselves.

In submitting to the scientific world a new form of instrument, which has been found eminently advantageous in the delightful department of pneumatic chemistry, a certain degree of diffidence, perhaps, properly attends its introduction; but, without subjecting myself to a charge of egotism, I may be allowed to remark, that though the apparatus, forming the subject of the following "Memoir," has been employed by myself in a long and extensive series of experiments, both for the purpose of trial, and with a view to chemical research, I have not found it advisable to effect any material alteration with an eye to improvement, nor have I felt the slightest inducement to exchange its use for that of any other instrument with which I have the pleasure to be acquainted,

though I should be sorry to be deemed insensible to the merits of several, which are well known to the philosophical world. As, however, inventors may be naturally supposed to evince a strong partiality for the result of their own schemes, I have aimed to put a check upon feelings of this description, by availing myself of every opportunity to bring the operation of the instrument under the inspection of such scientific minds as have been willing to oblige by their attention; and, though the merits or demerits of every invention necessarily ought to abide the ordeal of repeated experiment, upon which the legitimate tribunal of science is erected, I feel no small gratification in the concurrent opinions which have been expressed in regard to the utility and advantages of the Universal Portable Eudiometer, while I rely with earnestness upon the rectitude of future decision.

Description of the Universal Portable Eudiometer.

The philosophical apparatus to which the title of Universal Portable Eudiometer has been applied, is perhaps not destitute of such claims as may, on experience of its use, sanction the application of the term, which the inventor has been induced to adopt more from a conviction of its being expressive of the principle and application of the instrument, than otherwise.

The eudiometer, which we are now to describe, is applicable to the purpose of chemically examining gaseous mixtures, by detonation with the electric spark, as in the eudiometers of Volta and others, or by absorption, upon the principle of the instrument invented and described by Dr. Hope; and equally so, as regards the former case, whether the gases require to be operated upon over water or mercury; nor is the use of the pneumatic trough, which is indispensable to other instruments of this denomination, at all necessary in either case.

The apparatus may be regarded, to a considerable degree, as a self-acting instrument, charging itself with gas, and regulating the volume to be operated upon, by the mere turning and management of a small stop-cock.

In the *ordinary modes of* analysis, *dependent on the presence of* definite *portions of oxygen*, and detonation of the gaseous mixture by the agency of electricity, it is necessary to transfer the gases under examination, from their respective bladders, or gas-holders, by means of a curved pipe, into the eudiometer tube, as it stands over the fluid of a pneumatic trough, which is often a tedious, and sometimes an uncertain operation, as regards the quantities intended for admixture. This inconvenience is completely obviated in the apparatus under consideration, by the attachment of a small reservoir, containing the explosive mixture, placed closely in contiguity, and communicating directly with the tube of detonation, and which, though perfectly secure from accident, during the transit of the electric spark, may be instantaneously removed or not, dependent on the choice of the operator.

In all manipulations with this eudiometer, a security is effected against the escape of any portion of the gaseous mixture, so frequently incidental on its enlargement of volume, at the instant of its decomposition, when the common eudiometer is employed; while, by means of the instrument of which we are treating, that enlargement of volume is accurately measured, and the amount registered, so as to be read off with facility by the experimentalist; as is also the residual gas, when there is any, in the tube of detonation.

As it is not to be apprehended that any of the fluid, necessary to be employed in the several manipulations, can be thrown about, as in the ordinary mode of operating, the instrument may be used with entire convenience, in any situation; it is perfectly under the command of an individual, and is, I believe, sufficiently portable, as well as simple, for all occasions on which eudiometers are employed.

The base, foot, or stand of the instrument, 1, 2, 3, 4, fig. 1, is formed from a solid block of the best well-seasoned *lignum vitæ*, five inches in length, four in breadth, and one inch and three-fourths in thickness.* Fig. 2, represents a longitudinal

* For the more perfect security and stability of the apparatus (a consideration of no little importance to those who are actively engaged in the employment of philosophical instruments), the bottom and sides of this block may be cased with well-polished sheet copper or brass, and firmly fixed, by means of cement or small screws. One of the eudiometers in my possession is thus constructed; but when a good sound piece of lignum vitæ can be obtained, this extra measure is by no means indispensable.

and perpendicular section of the base, designed to bring more effectually under comprehension the grooves, or channels, which connect the cavities of the detonating and register tubes; 5 being the place of the former, and 6 the latter tube; 7 an orifice perpendicularly under the tube of detonation, enabling the operator to clean the inside of the tube, and affording access thereto on other occasions. The opening is closed air-tight, in ordinary, by means of a good sound elastic cork; 8 is the place of the stop-cock, seen at 9, fig. 1, by which the fluid in the tubes is regulated or drawn off; 10, fig. 1, is a strong eudiometer tube, of thick glass, a cubic inch of the cavity of which is graduated into tenths, fiftieths, and hundredths; it is of the common construction, as regards stability, and made with a circular rim, which is firmly cemented into a cavity in the stand, immediately over the perpendicular channel 5, fig. 2; and is further secured by a strong circular brass collar, passed over the tube from the top downwards, and screwed or cemented into the block.—This tube is mounted with the conducting wires 11, 12, and surmounted with a brass cap 13, from the centre of which arises the transfer tube 14, about one inch in length, having a bore of one-eighth of an inch diameter, and being provided at the top with the usual kind of receptacle for the screw of the small stop-cock 15, the other end of which is attached to the socket, or screw-piece, of a small varnished gas bladder 16. This transfer tube is connected with the cavity of the glass below, by means of a minute channel drilled through the crown of the detonating tube. 17 is a solid glass pillar, which obtains motion horizontally, from the brass foot 18 revolving, by means of a screw, working in a receptacle, imbedded in the block or stand of the instrument. This pillar is mounted on the top by a brass cap and ball 19, through a channel in which slides freely a wire about two inches in length, carrying the two polished balls 20, 21; the former one and a quarter inches diameter, and the latter about three-fourths of an inch.

At the opposite angle of the stand rises, to an equal height with the last mentioned, the brass pillar 22, with a globular or ball top, and furnished with two hooks opposite each other, 23, 24. This pillar, like the one of glass, at the opposite angle, screws into a brass collar, or foot-piece, fixed in the stand of the apparatus.

The register tube 25, about sixteen inches in length, is of strong glass, and may be five-eighths, three-fourths of an inch, or even an inch in bore; being supported by the brass foot 26, which, with the aid of a leather, or elastic gum collar, screws air-tight into the block, or foot of the eudiometer, immediately over the channel 6, of fig. 2; which is provided with a proper screw-piece for its reception. This tube is also graduated into cubic inches, subdivided at convenience, and numbered from the bottom upwards;—the graduation is easily obtained, by weighing into the tube water or mercury, agreeably to the ordinary rules of such manipulations.

At the time of effecting this graduation, a straight, blackened rod of beech wood, about the eighth of an inch in diameter, is to be inserted down the cavity of the tube, and of a length sufficient to project an inch above the top orifice. The insertion of this rod, at the time of graduating the tube, is, as will be hereafter seen, necessary, in order to obtain the amount of space occupied by its bulk, which is important in correctly ascertaining the degree of enlargement in the gaseous volume, during its explosion by the electric agency, when the presence of the rod in the register tube is requisite.

The top of the register tube is surmounted by a turned capital of brass, which occasionally receives a small glass funnel, through the medium of which the instrument is charged with fluid, when required for chemical operations.

Fig. 3 represents an additional stop-cock 27, mounted with a small gas bladder, and provided with a connecting piece 28, which is designed to screw, occasionally, upon the upper end of the stop-cock 15, fig. 1; the gas bladder 16 being removed for such purpose. By this provisional arrangement, any residual gas, from the detonating tube 10, may be transferred to the bladder 29, for the purpose of further testing or analysis; which may now be managed, by passing

* From our engraver not attending to the *instructions sent him, fig 2, representing* a section of *the base of the eudiometer,* has been placed in a *vertical instead of a horizontal* position, to correspond *with fig. 1.*—*Ed. M.M.*

the residual gas into one or more test tubes, over water, first connecting a small curved jet, having a fine orifice, to the screw of the stop-cock, with which the last-mentioned bladder is furnished.

Preparation of the Eudiometer for Use, and Mode of Operation.

When an unknown combustible gas, or gaseous mixture, is to be examined by this instrument, it is first combined in the required proportion, with pure oxygen, and transferred to the small varnished bladder 16; but before the stop-cock 15 is screwed to the top of the tube 14, the cavity of the eudiometer is to be charged with fluid. The stop-cock 9 being shut, and a small glass funnel inserted at the orifice of the register tube 30, the operator is to commence cautiously pouring in fluid, until it rises to the top of the detonating tube 10, to which it will ascend agreeably to the known laws of hydrostatics, and, as it rises, expel the air from the detonating tube before it, through the channel of the metallic transfer pipe 14.* The bladder 16 is now to be placed in its proper situation, and a communication effected between it and the detonating tube, by opening the stop-cock 15. The operator should now make gentle pressure on the bladder, with one hand, while with the finger and thumb of the other hand he grasps the handle of the plug which regulates the discharge of gas through the stop-cock 15. The eye of the operator being next directed to the figured divisions of the detonating tube, and gentle pressure on the gas bladder continued, he will readily perceive when the required volume has entered, and then instantly suspend the communication, by closing the passage of the stop-cock; or he may charge the tube of detonation with any volume of the gas, *ad libitum*, and then regulate the quantity to be detonated, by keeping the finger and thumb upon the plug of the stop-cock, until the pressure of the column of fluid in the register tube has returned to the bladder, by its ascent in the tube 10, all but the required volume of gaseous mixture. A slight degree of attention to the management of the stop-cock will, on a single trial, show with what facility and exactitude this operation may be accomplished.

It is not advisable to operate upon large volumes; from three to five-tenths, according to the explosive force of the mixture, is as much as the instrument has capacity or is intended in general to measure, as regards enlargement of volume, and this quantity is for every useful purpose, I believe, as advantageous as ten times that amount of volume would be. The required volume of gas being admitted, the ball 21 is made to approach the ring of the conducting wire 12, by turning the pillar 17; the large ball 20 will now be brought into a convenient position for receiving the electric spark.

The apparatus being in this state of preparation, the blackened rod of beech, box, ebony, or other hard wood, after it has been passed through a cork at its upper end, is to be inserted, by means of the cork, into the hollow part of the brass capital, with which the register tube 25 is surmounted, and the rod pushed through the cork until the end of the former reaches the bottom of the tube.* Two or three fine grooves cut longitudinally, on the circumference of the cork, are requisite to the egress and ingress of atmospheric air to the cavity above the fluid of the register tube, during the operative process with the eudiometer. Now let the operator open the stop-cock 9, and discharge the water from the register tube, until the surface thereof is seen on an exact level with the surface of the water in the tube of detonation; for by the introduction of the volume of gas their equilibrium will have been destroyed. During this operation of letting off water from the register tube, the column of fluid in that of detonation, will not be in the slightest degree

* When the bladder 16 contains a considerable volume of explosive gaseous mixture—for example, oxygen and hydrogen, in the proportion in which they are employed for the gas blow-pipe—and the operator wishes to avoid the trouble, or inconvenience of removing the gas bladder, all risk of explosion may be completely guarded against, by charging the cavity of the tube 14 with a few layers or strata of common sponge, but which should not be pressed over tight, lest they impede the transit of the gas from the bladder reservoir to the tube of detonation. The only chance of such an event as an explosion of the gas reservoir obtaining, perhaps, would be from the passage through the stop-cock of the bladder 16 not being perfectly air tight. This principle (the adoption of a sponge medium) I have elsewhere shown, in "An Essay on the *Combustion of the Mixed Gases, &c.*" affords absolute security from explosion and its contingent consequences.

* This rod has been previously described.

affected. One end of the brass chain seen in fig. 1, is now to be hooked to the ring of the conducting wire 11, and the other end to the hook 24, of the brass pillar 22. A second portion of chain 23, may be continued at the pleasure of the operator to the table or ground, which, under particular circumstances, may be found desirable.

A small electrical machine having been previously brought into good condition, the operator is to place the eudiometer on the table, so that the ball 20 may be within a short distance of the conductor of the machine, or he may with equal convenience grasp the instrument firmly by the base or stand with one hand, while he turns the cylinder of the machine with the other. The ball 20, on receiving a large spark from the charged conductor, transmits it along the wire to the ball 21, and both being insulated by the glass pillar 17, the electricity is directed in a dense spark, by the conducting wire 12, in contact with the ball 21, through the gaseous mixture in the tube of detonation, and finds a ready course to the ground by the chain 11, 24, &c. The double motion of the balls 20, 21, by the sliding of the wire 19, and the turning of the glass pillar 17, enables the operator to regulate the strength of the spark with the utmost facility.

The operative chemist needs not to be told that the combustible gaseous mixtures at the moment they are made to combine by the transit of the electric spark, obtain very considerable enlargement of volume, which we may distinguish, by calling it their *explosive force.* This degree of explosive force in respective mixtures, perhaps it would be advisible always to ascertain with precision, and we may presume it is an advantage to be enabled to acquire this information at the same time, and by means of the same instrument, through the medium of which the first analysis is sought. At the instant the electric spark passes between the knobs of the conducting wires 11, 12, within the tube 10, the water is seen to retract therein, and ascend in the tube 25, to a height corresponding with the enlargement which the gas obtains in volume, at the *instant of decomposition.* This effect is *of a momentary nature,* and the fluid in the instrument having acted as a valve and precluded the escape of gas, returns up the tube of detonation, until it reaches the line of graduation which marks the diminution or volume of gas that has disappeared. On now turning the eye to the register tube, a wet line of demarkation will be seen, upon the blackened surface of the rod before described, denoting the exact height to which the fluid has been forced to ascend, during the operation; and a moment's calculation—(both tubes being graduated to show their cubic capacity)—in which we are to regard the original volume of gas introduced for detonation, will give us the amount of explosive force, or the number of times the volume of gas has enlarged at the moment of its chemical union.

On the removal of the gas bladder 16, and the substitution of the bladder 29, fig. 3, with its stop-cock 27, and connecting piece 28, the residual gas may be transferred thereto, by pouring fluid by the glass funnel into the register tube, until the whole of the gas has been driven through the tube 14 into the bladder; and if the operator deems the residual volume too small, the operation may be repeated any number of times, until a sufficiency be obtained to answer the purposes of further inquiry. To enable the operator to let out, and entirely discharge at pleasure, the residual gas, from the eudiometer tube, after detonation, should he not wish to preserve it, and to repeat the experiment any number of times, without removing the bladder 16, a small screw 31 having a stout milled edge, is provided for such purpose, just below the collar of the tube 14, and by a turn or two of this screw, egress is readily given to the residual gas, the passage of the stop-cock 15 being kept shut during this operation.

Application of the Apparatus to the Analysis of Cases, requiring to be operated upon over Mercury.

The analysis or examination of gaseous bodies, which are wholly or in part absorbable, or otherwise deteriorated by their contact with water, and for which the philosophical inquirer finds it requisite to substitute a pneumatic apparatus charged with mercury, instead of the former fluid, are found not unfrequently to constitute an interesting feature of his researches.

Though the principle of transference, with gases requiring to be worked over mercury, remains the same as with the other fluids, in all the ordinary manipulations of pneumatic chemistry, these operations are perhaps, upon the whole, not quite so easily performed, and they will therefore demand a slight degree of extra attention from the chemical student.

Water has the property of wetting and adhering to the surfaces of jars, tubes and other apparatus employed in all operations over the pneumatic trough, which effect does not obtain from the use of mercury. The adhesion of water to the surfaces of glass jars and other solid bodies, is considerably greater than that which exists between its own particles; and hence it is that a stream of gas expelled from apertures, under the surface of this fluid, is found to ascend without difficulty into the tubes and other receivers, in the form of distinct bubbles, and without an effort of recession. The nature of the mercurial fluid is not so happily adapted to ensure similar results; the metal possesses no tendency to adhesion with the surfaces of the jars and tubes, nor can it be brought into close contact with them; whence it by no means unfrequently occurs that streams of gas ejected from the orifice of a transfer pipe, while used under mercury, suddenly return and escape beneath the ring or edge of the receiver instead of ascending in the form of bubbles through the fluid metal, as gas is wont to do when the pneumatic trough and jars are charged with water.

To obviate these untoward consequences, which often prove exceedingly vexatious to the student in operative chemistry, the employment of transfer tubes or pipes, the extremities of which are curved *upwards*, and made to terminate in a small orifice, so as to deliver the gas at a point *within* the jars, and an inch or two above the lower surface of the metal, becomes important, and will generally secure the success of the operation.

These obstructions to the transference of gases being found to obtain much more frequently, when foul or dirty mercury is employed—for the metal will sometimes become partially oxidated, and contaminated by the action of adventitious substances, contact with which is unavoidable in the proceedings of the laboratory;—it is of advantage to clean and purify the mercury for all purposes of this kind, and the superior degree of success consequent thereon will amply repay the operator for his attention. Wiping the surfaces of all glasses concerned in these pneumatic researches frequently by means of a clean dry cloth, will also be found greatly to facilitate the proceedings of the operator. When the inner surface of tubes requires to be cleaned, it should be done by means of a small cylindrical piece of moistened sponge, and the operation afterwards finished by a little fine tow, or other soft material, fastened upon the end of *a flexible rod of wood*, the action of a wire, likely enough to be resorted to for such purpose in a laboratory, where such utensils are generally at hand, being frequently destructive of the tube.

Though the full force of these observations, as respects the management of gases over mercury, will not apply to manipulations with the Universal Portable Eudiometer, when the metal is employed—that apparatus being provided with the means of admitting the gas into the tube of detonation with perfect facility, *from the top downwards*, by which operation the metal is expelled with certainty before the gas, and the latter is made to occupy the place of the former to any required extent, by gentle pressure upon the gas reservoir—yet it is highly advisable to select or prepare the mercury for charging the tubes in a clean pure state; and before proceeding to operate, care should be taken to cleanse the tubes and channels of the eudiometer from all dirt and moisture, which may have accumulated or arisen from its previous use with water. Order, precision, and cleanliness of apparatus, are worthy of being ranked with the primary agents of success throughout the researches of philosophical chemistry.

Two slight deviations only from the mode directed to be adopted with gases analysed over water, as already described, are requisite for such as require to be acted upon over mercury.

First,—The channel of the stop-cock 9, and the screw and collar thereof, together with the socket or receptacle of the screw of the brass mounting 26 (imbedded in the block or base of the apparatus), which supports the register tube,

require to be well coated with a good varnish, prepared by dissolving sealing-wax in spirit of wine, by which they are protected from amalgamation of their surfaces with the mercury, the action of which would in time render them useless. All metallic surfaces coming in contact with the mercury should, therefore, be in like manner protected by the varnish.

Secondly,—As the ascension of the mercurial fluid is unaccompanied by the effect of imprinting a wet line of demarkation upon the surface of the rod attached to the use of the register tube, as in operating with water, the following simple expedient may be resorted to, and I have invariably found it to answer the desired purpose, by registering the height to which the surface of the metal ascends, during the enlargement of the volume of gas in the tube, with the greatest precision:—A thin circular disk of cork, a little more than two-thirds the diameter of the cavity of the register tube, and which may be cut by a fine-edged penknife, from one of those corks used for the purpose of stopping common phials—and they are always at hand in a well-furnished laboratory—is to be prepared, by making a crucial incision through its centre, and afterwards carrying the disk to and fro, by passing the rod through the central incision, until it slides with freedom, but yet remains sufficiently tight to obviate, by the elastic action of its component material, all motion from its specific weight, when the rod is placed in a perpendicular position. The rod with the cork disk being placed in the register tube, and the preliminary preparations for operating made agreeably to the directions given in a former section, the operator is made to slide the cork disk downwards upon the rod, until it rests upon the surface of the mercury in the register tube. The ascension of the mercury, consequent upon an explosion of the gas in the tube of detonation, occasions the disk to precede it in its passage up the tube, until it reaches its greatest altitude, where the cork disk remains stationary, and indicates the enlargement of volume which has obtained, and which may now, as in operating over water, be read off from the graduations of the register tube.

It being important in chemical researches, especially such as are connected with the weight, measure, and expansion of gaseous bodies, to regard a standard of comparison, we may, when operating with gases over mercury, by means of this eudiometer, resort to water as the *standard*, in our estimation of the explosive force, and reduce the result yielded by operating over mercury to the water standard. A few simple data will enable us to effect this object:—we will suppose a case, together with its solution, by way of illustration.

Let us presume that a given quantity—say the half of a cubic inch—of a combustible gaseous mixture under analysis, is found to enlarge in volume, or evince during detonation an explosive force equal to *five*, under a resistance or pressure of *three* cubic inches of *mercury;* then we may inquire what would be the amount of its explosive force, or enlargement of volume, from the same operation, under a resistance or pressure of *three* cubic inches of *water?*

A cubic inch of mercury, at 62 degrees of Fahrenheit, is found to weigh 3425.35 grains, and a cubic inch of water at the same temperature weighs 252.458 grains.

Furnished with the preceding data, we may resolve the question thus:—As the relative weight of mercury in the tube, during the first operation, is to the cube of the explosive force multiplied into the given or absolute weight of mercury, so is the cube root of the product divided by the given weight of water, to the result sought, and which by calculation will be found to yield 11.93, for the amount of explosive force over water.

Observations connected with the preceding Section.

In a previous section of this Memoir, it has been stated, in giving directions for the analysis of gases over water, by the eudiometer, that the apparatus may be held in the hand, or placed on a table, dependent on the choice of the operator, while he solicits a spark from the conductor of the electrical machine. The same option remains to the experimentalist, in operating with the tubes charged by mercury, but as the weight of the apparatus is considerably increased by the substitution of the metallic for the aqueous fluid, it will generally be found more convenient to dispose of the apparatus in a suitable position on the table, with its

conducting wire and balls in contiguity with the prime conductor of the electrical machine.

I may here observe, that I have never yet found it necessary, in my experiments with the apparatus in question, to substitute the charge of a coated jar for the electric spark drawn from the conductor of an active machine ; but in the event of such an arrangement being advisable, every operator will instantly perceive the mode by which the charge should be directed through the tube of detonation.

On the Analysis of Gaseous Matter by Absorption, and the Application of the Universal Portable Eudiometer to the Purposes of the Eudiometric Apparatus invented by Dr. Hope.

An extensive series of experimental results have pretty accurately shown to the satisfaction of the philosophical chemist, that a very trifling degree of difference exists in the proportion of oxygen combined with the atmosphere of the earth, whatever may be the altitude, season, climate, temperature, or general circumstances under which the experiments are made. Eudiometry, as a test of atmospheric purity, is consequently less frequently resorted to by the man of science, than formerly. It is, however, not the less desirable on many occasions to be enabled to ascertain, by the action of liquid agents, the proportion of oxygen, or other aeriform matter present in combination with any gaseous mixture.

The instrument principally employed for this purpose is the Eudiometer of Dr. Hope, with the management of which we may presume every operative chemist to be perfectly acquainted. This instrument consists of a bottle for holding the liquid agent, and is provided with a side opening or valve fitted with a ground glass stopper ; the upper opening or neck of the bottle being furnished with a graduated tube ground air-tight into the neck, and which tube is designed to contain the gaseous mixture to be examined. As fast as the oxygen is absorbed from the mixture in the tube by the liquid agent in the bottle, the apparatus requires to be plunged from time to time under water, to allow more of the fluid to rush in by the side opening, and supply the amount of *vacuum occasioned* by the *absorption of oxygen. Hence* the process is tedious, requires frequent attention, and the agent employed is progressively undergoing dilution.

The apparatus we have already described for the purpose of gaseous analysis by the agency of electricity, is applicable with equal facility to the examination of gaseous mixtures by absorption.

The gas to be examined is, as usual, to be transferred to the bladder 16; the tubes of the instrument 10, 25, instead of having water poured in, are to be charged with liquid sulphuret of lime, or other agent, until the fluid has ascended to the top of the detonating tube 10. The glass pillar and its balls, with the one of brass, together with the chain, may be for this purpose at the pleasure of the operator removed.

Let us now suppose the tube 10 to be charged with a cubic inch of the gas to be examined, and the stop-cock 15 closed to prevent its re-ascent to the bladder. A cubic inch more of the liquid is now to be poured into the register tube, if it should not already rise above the level of the same fluid in the tube 10, and thus the necessary supply will be furnished as absorption advances.

The instrument and the process may now be left to themselves, for as the absorption goes on in the tube 10, the descent of the liquid in the register tube removes the vacuum occasioned by the diminution of gas, and always without the liquid having suffered from dilution, so that when the operator returns after an hour or two, or at his convenience, in many instances, within a much shorter space, he has nothing to do but open the stop-cock 9 and let off the liquid,* until it stands at the same height in both tubes, when the diminution from absorption of oxygen and the amount of residual gas will be at once seen on inspection of the scale engraved upon the graduated tube 10.

The employment of the eudiometer constructed upon the ingenious principle originating in the invention of Dr. Hope, has, I believe, been almost entirely limited, by chemists generally, to the analysis of atmospheric air.—I have found the adoption of the eudiometric

* Thus removing compression from the residual gas in the tube 10, by lessening the unequal pressure occasioned by any greater altitude of the column of fluid in the tube 25, from which a slight error might arise.

apparatus, described in this Memoir, to the purposes of analysis by absorption, exceedingly convenient in accurately yielding me the per centage of carbonic acid gas in combination with carbonic oxide, &c., by the agency of liquid ammonia, a solution of potass, or pure lime-water; and, as the analysis proceeds without the necessity of any personal attention, after the apparatus is once put into action, or, as it were, set to work of itself, a considerable facility is acquired, during the examination, in like manner, of several forms of gaseous matter, which frequently occur to the chemical inquirer in a state of admixture.

Observations on the Admeasurement of Compressibility in Gaseous Matter, from the application of definite Degrees of Pressure, attainable by means of the Universal Portable Eudiometer, with some suggestions relative to the Condensation and Liquefaction of Gases generally.

Though certainly foreign to any original views entertained in the construction of this apparatus, it may not be wholly out of place to mention, that it may be rendered subservient, in a limited degree, to measuring the relative amount of compression which aeriform bodies undergo from definite applications of pressure. An example will suffice to show the simplicity of the operation.

Let into the tube 10, from its corresponding bladder, one-fourth of a cubic inch, or any other known proportion, of the gas to be examined, and cautiously note that the surface of the water be brought to a level in both tubes. Now if two cubic inches of water be poured into the tube 25, the degree or amount of compression which the gas undergoes from the pressure of eight times its volume of water (supposing one-fourth of a cubic inch to have been introduced) may instantly be seen from an inspection of the graduated scale upon the eudiometer tube 10; and so on with considerably higher degrees of pressure exerted upon various gases, the extent of pressure applicable being of necessity regulated by the altitude and capacity of the register tube 25.

The vast acquisition that has arisen to chemical science from the results of a *series of experiments* undertaken by Mr. *Faraday, at the suggestion* of our great philosophical chemist, Sir H. Davy, has suddenly opened to us an acquaintance with peculiar forms of matter previously unknown and unsuspected by the most acute researcher after the mysteries of nature; nor perhaps is it possible, thus early in the infancy of the discovery, to decide on a competent estimate of its importance, or its influence on the reasonings and science of future ages.

By the assiduous ingenuity and exertion of the above-named profound and accomplished chemist, many substances, which, when uncombined, had been recognised only under a gaseous form, are now exhibited in the solid and liquid state, by generating them in strong glass tubes, under various degrees of pressure, at a low temperature, and upon the removal of the pressure we witness their instantaneous return to the gaseous form. The disposition to permanent elasticity evinced by some of these bodies has been so great, that the slightest increment of heat has occasioned the spontaneous disruption of the strong tubes containing them, and the most violent and dangerous explosions have resulted.

The candour and research of Mr. Faraday have elicited a knowledge of the fact, that a few instances of the liquefaction of gaseous matter had, prior to the institution of his series of experiments, occurred without the knowledge or observance of several experimenters, while engaged indirectly or otherwise in subjecting aeriform bodies to condensation. See an "Historical Statement respecting the Liquefaction of Gases by Mr. Faraday," "Journal of Science," vol. xvi., page 229.

Some experiments on the condensation of gaseous matter by means of the instrument which forms the subject of this Memoir, and with which I succeeded, without difficulty, in reducing cyanogen to the liquid state, have suggested to me the construction of an apparatus upon a much more extensive scale (acting on the same principle to which I have referred the use of the eudiometer, in the present section), and by the employment of which I am persuaded many gaseous bodies might be subjected to condensation, and brought to the liquid or solid state with less labour, risk, and inconvenience—perhaps, in some instances, with a greater degree of success than by generating them under pressure in glass

tubes, which method is invariably accompanied by the probability of explosions.

My present remarks I would request to be understood rather in the light of suggestions than otherwise, while I would refer their execution to time and further experiment; and as the decision of the question does not entirely belong to the professed object of this Memoir, I shall content myself with an outline of the proposition.

It is not practicable to bend or seal stout glass tube of any considerable thickness, and which would consequently bear a very high pressure of many atmospheres. by the usual means employed at the table blowpipe; but a tube of this description, ready sealed and bent, of adequate strength and dimensions, might be obtained by a specific application at a glass-house. We will suppose its capacity to be an inch internal diameter, its thickness one-fourth of an inch throughout, and of a length from six to eight feet or more, agreeably to the choice, convenience, or objects of the experimenter.' A short leg communicating by a continuation of the same channel and internal diameter, and which need be extended only to a few inches in height, may be bent or set off at an angle of about 40°, and its open end mounted with a stout metallic cap carrying a screw-piece for the reception of a stop-cock capable of bearing high pressure, and the other extremity of which would, in like manner, connect itself with the mounting of a glass globe, or gas-flask, which we will suppose to possess a cavity or hemisphere of two or three inches diameter, and the structure of the glass to be equal at least to that of the tube, in point of thickness, resistance, and durability. We have thus an apparatus capable of opposing the amount of several hundred atmospheres of pressure, without risk of its disruption, and its power of resistance might be augmented by an increase of its solidity. The short leg of the apparatus, together with the flask being charged with the gaseous matter to be condensed, the pressure of an immense column of mercury might readily be brought to bear thereon, while the temperature of the gas in the flask and short leg of the tube might, without difficulty, *be reduced artificially* to many degrees below the zero of Fahrenheit's thermometer, by plunging them into a freezing mixture, or by the more powerful effect arising from the application of the sulphuret of carbon, and in some instances sufficiently cooled by the frequent sprinkling with highly rectified ether, by which several means the condensation of the gas to a liquid or solid form would be rapidly facilitated, and when the desired effeet had obtained, the plug of the stop-cock might be turned and the globe or flask with its contents removed in perfect security, provided there has been due attention directed in the first instance to the strength and stability of the apparatus.

In cases where a mutual re-action between the two bodies, the gas and the metal, should be apprehended, the operator might easily introduce a medium—a light impalpable powder for instance—floating upon the surface of the mercury in the tube, which would completely obviate decomposition arising from chemical affinity.

The condensation of gaseous matter and its consequent conversion thereby to the liquid, and in some instances to the solid state, furnishes materials for the basis upon which future genius and experience will erect a superstructure of unprecedented magnificence and importance to chemical science and the mechanical arts of the world. A thousand projects which would now be ridiculed as the day-dreams of the visionary and the enthusiast, will find in the successful production of liquid and solid matter from aeriform bodies, more than the ample means of realisation. What, for example, should we think of the adventurous aeronaut who now requires the production of many thousand cubic feet of hydrogen to render buoyant his etherial car, and waft him to the vast altitudes he is capable of thus attaining in the regions of the atmosphere, when he should propose, instead of resorting to the manufacturer of coal gas, or the slow decomposition of water, for the agency of his flight, to avail himself of the simple expedient of removing compression from the contents of a strong vessel of some cubic inches capacity, preserved at a low temperature, and in the space of a few minutes dilate his splendid balloon by the

rapid transition of solid matter to the gaseous form, and in the next instant spring majestically to the skies! Armed with the exercise of a similar agency, the miner, too, might rend with facility and tremendous effect vast aggregations of the rocky impediment which now speaks a bold defiance to his most vigorous efforts, even when seconded by the happiest expedients of the most consummate genius in science; and, alas! it might moreover be anticipated, that the deadly engines with which kings and tyrants are wont, at the suggestion of hirelings and slaves, to arm the hand of man against his fellow man, would derive from the sacred influence of philosophy an accession to their destructive and inhuman power.

The consummation of events like these may *now* be viewed with doubt, and their suggestion receive the sneers of derision; but they are, notwithstanding, within the scope of possibility, and, ranking in alliance with undertakings of equal grandeur, originating in analogous means, will, doubtless, constitute a feature in the progressive advancement of future science.

FORCE EXERTED IN ARCHERY.

Sir,—In addition to what your correspondent J. W. has advanced, relative to the muscular force exerted in archery, I would say that if A. M. will reflect a little he will find it very easy to conceive how a muscular force of 100 lbs. is exerted.

Let A B, in the prefixed diagram, represent the bow, and C a weight of 50 lbs. hung on the middle of the bow-line. Then let D E be the direction of the force exerted by the *left* hand, as in the ordinary way of shooting; then, if the bow be held by the left hand, and the weight C of 50 lbs. applied, it is very evident that a force of 50 lbs. is exerted with the *left* hand only, for it has to *support* the 50 lbs.; and 50 lbs. supported by the *left* hand, and 50 lbs. pulling in the opposite direction F C, will make 100 lbs. Now, let the weight C be removed, and the right hand applied to the point F, in the direction F C, and let it draw the bow-line to the same extent as the 50 lbs. weight did. A force of 50 lbs. is now exerted with *each* hand, in opposite directions; for the left hand may be said to support a weight of 50 lbs., and the right hand also exerts a force of 50 lbs. to pull the line to the same extent as did the weight C of 50 lbs.

I am, sir, yours truly,

J. L.,

A young Mechanic.

KNELLER'S PATENT PROCESS OF EVAPORATION.

A patent was granted to Mr. Wm. Godfrey Kneller, of Mitcham, chemist, on the 24th August last, for "certain improvements in evaporation." We extract the following particulars of these improvements from the patentee's specification.

Mr. Godfrey first effects a sudden compression of common atmospheric air, and then conveys volumes of this compressed air, "by means of inverted moveable chambers, or ventilators," beneath the surface of the heated fluids or liquids to be evaporated; when these volumes of air, "becoming suddenly expanded by the heat of the said fluids or liquids, pass underneath the lower edges of the said inverted chambers, into the adjoining chambers, and pass off through holes or apertures provided in the upper parts of the said chambers, and through the superincumbent fluids or liquids, loaded with the aqueous or other vapours." On "these chambers or ventilators being raised or elevated above the surface of the said fluids or liquids, they again become filled with fresh air, which

is also in its turn conveyed beneath the surface of the fluids or liquids by a repetition of the movement of the ventilators." In this way "a continual and rapid evaporation" of the heated liquids is stated to be produced; and it is to be inferred, from the process being made the subject of a patent, that the patentee considers it superior in these respects to every other previously in use. We have heard that it has been applied by Mr. Kneller to the evaporation of brine, with a degree of success which would fully justify such a conclusion.

Mr. Kneller does not claim as his invention "any particular forms or shapes of apparatus," by which this mode of evaporation is to be carried into effect, but proposes to "avail himself of any which may be fit or proper for the purpose." He gives, however, by way of examplification, a detailed description, illustrated by drawings, of the sort of apparatus he would recommend for the evaporation of brine; and also shows how his method may be applied with advantage to accelerate the production of steam in high and low pressure boilers.

It is observed that "where the ventilators are to be employed in stills, or steam boilers, it will be necessary that their shafts or axes be made cylindrical, and passed through stuffing boxes, to prevent the escape of vapour or steam thereby; and that where cooling is to be performed, the operation may be effected in the usual open vats or other barrels commonly employed."

RUSSIA LEATHER.

Sir,—I lately read, in your useful publication, some observations on Russia leather; as they appeared to me to be very erroneous, I have taken the liberty to state, for the information of your readers, that the Russia leather in England, so called from its peculiar smell, (but here called *Youkter*,) will and does both mould and mildew, in confirmation of which I herewith send you two specimens cut from hides prepared by different manufacturers.

Your correspondent also states that the peculiar smell is caused by the leather *being tanned with birch bark*, or dressed with tar extracted from the birch tree. This is also erroneous; for I can assert, from long observation, that the tanners universally use willow bark.

The process of curing the leather used by bookbinders, is kept as much as possible a secret by the Russian tanners; but from all I can hear, and from every observation I have been able to make, (and I have been both curious and inquisitive on the subject for many years,) I believe the peculiar smell arises from the length of time taken to prepare the hides, (called in England, I think, felling,) before they are put into the tan. The leather never acquires the smell under a two years' process.

There is a kind of leather called *Chorney Werostock*, (of which I also send you a specimen,) used by the lower classes here for making boots, &c., and which is made water proof by a composition, in which there is a mixture of some kind of tar or rosin; but I can confidently state, that nothing of the kind is used in preparing the leather for the use of bookbinders.

Trusting the foregoing information may prove acceptable to your readers, I remain respectfully yours,

J. K.

St. Petersburgh, 8th May, 1834.

[The specimens of leather obligingly forwarded with the preceding communication may be inspected at our office.—Ed. M. M.]

EXPERIMENTS ON THE CONTRACTION OF CAST IRON BY FROST. BY MR. W. REED.

Sir,—I send you some observations on the contraction of cast iron in Russia by frost.

In the summer of 1832 I had a three-throwed crank to turn, with four bearings. After the crank parts were turned, I filled them up with dry beech, to stiffen the work for turning the bearings, and left it in this state in the lathe. During the following winter, one sharp frosty night, it fell out of its centers. I saw that nothing could have touched it; for there was a slight covering of snow over it, which had remained the same for some days, and there was no foot mark near.

The summer following I procured a cast iron shaft, ten feet long, six sided,

and three inches diameter throughout. I then took a dry fir straight-edge, twelve feet long, one inch thick, and four inches wide, which had been in use ten or twelve years, and was of course well seasoned, and on this I screwed two brackets, so as to feel that they touched each end of the ten feet shaft. When these dimensions were taken the thermometer in the shade stood at + 14°. Reaum. (63° Fahr.) Last winter I had this shaft removed out of doors, and laid on two bricks, that it might be the more readily measured, and the frost have a better chance of acting on it. After the frost had set in some time, and when the thermometer was — 14°. Reaum.—making altogether a difference of 28 degrees—the contraction was one-tenth of an inch in the ten feet. I measured it again next morning, and found the contraction to be exactly the same.

Now, to have an idea of the practical importance of such a degree of contraction as this, we have but to consider that one-tenth of an inch in ten feet is equal to one inch in every 100 feet, or seven inches in an iron structure of the length of Southwark-bridge. Nor should the engineers of your country contemn such a source of danger from a notion that such a degree of cold as —14°. Reaum., is not likely to be experienced in the latitude of England. For in the winter of 1814, when the Thames was frozen over, and there was a fair held upon it, the degree of cold was fully equal to this.*

The iron shaft was again measured, when the cold had increased to 21°, and it was found to have shortened exactly one-eighth of an inch.

The cold here during the past winter has never exceeded 25°; but this is quite enough, since it is sufficient to reach both the water and gas pipes, and to cause immense inconvenience; for if such pipes are once frozen, it is of no use meddling with them till April or May. Even as late as July 4, the frost has been found in the ground four feet below the surface in particular situations. Coal gas condenses at 10 or 12 degrees of frost in out-door situations. A gentleman that has a large establishment in St. Petersburgh, lighted with coal gas told me that he had sad trouble with the lamps at a distance from the building. There are two gas lamps at the principal entrance to the factory where I am employed; the pipe is brought in a slanting downward direction inside the building, and a copper vessel is attached to it by a small cock and screw, to receive any of the gas that may be condensed; but though some condensed gas does find its way into this vessel, the cold is so intense that the pipe is at times frozen up with a solid body of ice to within a foot of the burner, which of course puts out the light. I have taken the copper vessel when thus filled with frozen gas, and put it on a slow fire, where as the liquid evaporated it burned with a yellowish blue flame, sufficient to show that it was hydrogen gas. I am, dear sir, yours truly,

WM. REED.

Peterhoff, Jan. 1834.

* The thermometer in England has been observed as low as 2 deg. below zero of Fahr. scale, which *is 13½ deg. below the zero of Reaum.* ED. M. M.

MARYLEBONE LITERARY AND SCIENTIFIC INSTITUTION.

Extract from the Quarterly Report, read to the Members, May 27, 1834.

" In the short period of one year from its establishment on the present plan, the committee have been enabled to take premises more extensive and commodious than those of any similar institution in the metropolis. They possess already a library of 2,000 volumes, among which are many of the most valuable standard works in the English language, and a reading-room, supplied with ten daily papers, and every periodical work of merit. Classes for the instruction of members in mathematics, chemistry, botany, music, and the French language, have been formed; and lectures are regularly delivered by eminent professors, among whom are—Sir A. Carlisle, Dr. Lardner, Dr. Copland, Dr. Southwood Smith. Messrs. Hemming, John Taylor, Burnett, Wallis, and M'Culloch.

" The increase in the number of subscribers, during the past quarter, having been greater than that of any preceding quarter (135 new members having joined the institution during that period), induced the committee to make arrangements for a more commodious lecture-room. The negotiations which were then entered into for the purchase of addition al ground are now completed, and the erection of a theatre, capable of containing 850 persons, will immediately be commenced."

INQUIRIES.

Electrical Machines.—Sir, I have in my possession a piece of plate glass, out of which I wish to make an electrical plate machine; I have therefore to solicit, through the medium of your valuable Magazine, an answer from some of your numerous mechanical readers, to the following questions. Permit me to add, that I hope they will not for a moment hesitate in imparting to a *young* inquirer after knowledge, *all* that information which is essential to the production of a good electrical machine.

1. By what method can I convert an irregular sided piece of glass into a true circle?

2. How is the hole in the centre of the circle to be made; and by what means is the axis by which it is to be turned (when made) secured, so as to be able to turn the glass when four rubbers are pressing rather *hard against it?*

3. The thickness of the glass is about $\frac{3}{16}$ths of an inch: will this be a sufficient thickness? The *utmost* size that I can make it, will not be more than 13 inches diameter.

4. Will a machine of that size be powerful enough to perform all the common electrical experiments, such as firing gunpowder, spirits of wine, the thunder-house experiment, &c.? I am, &c. J. L.—B********, April 12, 1834.

Grinding and Polishing.—Sir, There is a piece of information which is very much wanted, and for which you may look in vain in the large Encyclopædias, namely, the mode of polishing by hand in the small way. I have an idea, that it is the powder of the substances themselves which is rubbed off in the process of grinding, that is employed to give the last exquisite polish; at any rate, it must be so with the diamond.——I am, &c. yours, G. DAKIN.—Dereham, March 3, 1834.

Optical Instruments.—Sir, Can any of your correspondents give me practical directions for constructing a *Catadrioptrical Phantasmagoria*, of which a brief description is given in Dr. Brewster's Natural Magic? Supposing the diameter of the concave mirror to be 9 inches, and its surface nearly flat, I wish to know the size of the box or case, the size and focus of the lens for magnifying the objects, &c. &c.; I have been informed by an optician that the thing is altogether impracticable. I should also like to know what kind of an object glass I must procure for a magic lantern, the plane convex lens or bull-eye being 8 inches diameter and 10½ in. focus?—I am, &c. J. BATEMAN.

Weights and Measures.—Sir, Would you have the kindness to inquire, through the medium of your valuable Magazine, whether the weights in the town of Lincoln are the same as in the other parts of England, and how many pounds *butchers'* weight go to the stone? By so doing, you would oblige your constant reader, J. P.

Creaking Shoes.—Sir, I am a very nervous and irritable subject, and when employed in my study, am annoyed by the slightest disturbing circumstance, even a whistling wind, or a sudden crack in the furniture; but of all things the most obnoxious to me is the creaking of shoes or boots, either in a room or the street. If any of your readers can inform me of a preventive or remedy, they will confer an everlasting obligation on a real sufferer. I have had recourse to keeping the soles constantly damp, but this is liable to cause a cold by its effects on the feet, and also soon destroys the stitches.—I am, &c. S. S.—Gray's Inn, May 12, 1834.

Ascent of Smoke.—Sir, Is there any state of the atmosphere during which smoke will not ascend; and if so, what is that state, and how does it operate to prevent smoke from ascending? There are times when smoke seems to ascend much less readily than at others, and this I have heard attributed to the "heaviness" of the air. But surely this must be an error. Would not the smoke of a fire kindled on the top of a high mountain roll downwards instead of ascending; and that, not because the air in such a situation is heavier, but, on the contrary, because it is too light to afford the smoke the requisite support? If it were true that the denser the air, the greater is the difficulty in ascending in it, would not the same principle apply in the case of liquids, and might we not thence expect a cork or a ship to float more buoyantly in fresh water than in salt, contrary to the well-known fact. I trouble you with these queries from having more than once heard the remark made in London, that "the smoke does not ascend to-day, because the air is too heavy." The inhabitants of this city should know something of smoke; but if they are in error touching the cause of its not ascending, I trust that some of your ingenious correspondents will take the trouble to enlighten them. *Ex fumo dare lucem*, is, I hope, an object not unworthy of the "Mechanics' Magazine," even in a case of so little importance as the present.—Your obedient servant, Z.—April 22, 1834.

Sir,—A subscriber to the Mech. Mag., would be much obliged to any of its ingenious correspondents to inform him, how a square hole is to be filed by a round file?—B. T.

NOTES AND NOTICES.

An iron carriage, designed as well for heavy guns as for light field-pieces, has been constructed by order of Marshal Soult, under the direction of Captain Thierry, of the French artillery, and tried in the presence of the officers of that corps stationed at Nevers, when it met with their decided approval. It consists wholly of wrought iron, is much simpler in its construction than the wooden carriages at present used, and is of the same weight. The wheels are likewise of iron, of an elegant and peculiarly light make, cost less than any wooden wheels, and may be promptly repaired on the spot when injured. The "avant train" is of the same material as the carriage, and bears a munition box of wrought iron, modelled on a similar principle to the vessels for water used in the French navy. An apparatus of greased leather encloses the box, and renders it impenetrable to moisture. By means of a mechanical power, derived from a simple iron lever, the carriage is arrested on the chassis, after its recoil, at a convenient distance for reloading. After this last operation, the mechanical check is removed, and the carriage descends to its proper position in battery by its own action, with a uniform motion, and without manual labour. Captain Thierry has also so arranged the construction of the chassis, which is made of iron, as without exposing it to too severe a strain, has enabled him effectually to master the recoil of the piece, and within far narrower bounds than can be set in the case of any wooden carriage. With a charge equal to one half of the weight of the ball, and after simply moistening the chassis, the recoil has never exceeded one metre and forty cents ($55\frac{260}{1000}$ inches).—*United Service Journal.*

The House of Commons has, on the motion of Mr. Chas. Grant, appointed a Select Committee to inquire into the best means of promoting steam communication with India. The Messrs. Seaward, of the Canal Iron Works, in a pamphlet which they have recently published on this subject, recommend that vessels of very large capacity should be employed—of 1,600 tons, for example, with engines of 246-horse power. Such a vessel, they say, would allow of 900 tons being appropriated to merchandise, 100 to provisions and water, and 460 to coals—which last would suffice, with occasional assistance from the wind, to carry her to the Cape, where a further supply of fuel could be obtained. The time occupied in the voyage is calculated not to exceed eleven weeks.

"I perceive," says Kinclaven, "that Mr. Cheverton *declines giving a solution to the question* (see No. 562). He kindly informs me, 'that it was a stale manœuvre my proposing it.' Well, well; if the readers of the Mech. Mag. should think so, then let it be so. Still I believe that most of them will agree with me that Mr. Cheverton himself has been guilty of a much staler manœuvre, in trying to act the part of the fox in the fable, 'by contemning that which (he knows right well) is far beyond his reach.' There are also some most unfounded statements in his last postscript, which I shall reply to in due time. For a short period I leave him to the tender mercies of his new female opponent, the highly-gifted M. S."

A printed paper has been sent to us, entitled, "A General Description of Proposed Improvements in London, projected by Mr. W. D. Holmes, C. E." We do not approve of all the author's suggestions, but there are two of them which we think extremely well deserving of consideration. The first is, that the Regent's Canal should be drained and converted into a railway, in which case it would form an extension of the Birmingham line, to the Thames, through one of the busiest portions of the metropolis. The second is, "to provide means for collecting, carrying away, and rendering available, as manure, the filth which now runs from the common sewers into the Thames" (a thing often proposed before). Mr. Holmes estimates that "the amount of manure now passed into the river and otherwise wasted, exceeds 12,000 tons per diem;" and that it "may almost, without expense, be concentrated to about 7,000 tons, which will yield a profit of 400,000*l.* per annum, after paying all expenses attending it."

The Birmingham Musical Festival will take place, under the patronage of their Majesties, in the second week of October next. The spacious hall, in which the performances are to be held, is rapidly finishing; it will undoubtedly be one of the finest and best adapted rooms in Europe for the production of grand musical effects. The stupendous organ is also advancing towards completion. The hall, though of such dimensions as to be capable of holding nearly 8,000 persons, is so admirably constructed for the free transmission of sound, that it is believed the voice of a single speaker will be heard in any part of the vast area. —*Cheltenham Chronicle.*

Mr. Barton complains that Mr. Baddeley has misrepresented the actual construction of his metallic piston, in his communication of last week, respecting an alleged improvement of it by the Messrs. Heaton. He promises to send us, in time for insertion in our next Number, a paper in which this will be clearly demonstrated.

The contractors for executing the metropolitan end of the Birmingham railway, commenced operations on the morning of Wednesday last.

The completion of the beautiful new cut, by which the drainage of the Bedford Level has been rendered complete, and the Wisbeach river made navigable for vessels of 200 tons burthen, as far as the town of Wisbeach, was celebrated by a grand festival on the 23d ult. The plan was laid down by Mr. Rennie in 1824, and has been executed under the direction of Mr. Tycho Wing. It has cost about 200,000*l.*

Errata in Mr. Rutter's paper in last Number.

P. 141 l. 8 col. 2 for "interiors," read "interior."
41 for "so as," read "so long as."
142 17 col. 1 dele "an."
18 col. 2 for ("sp. gr. 475 h." 550,") read ("sp. gr. 475 to 550.")
143 1 col. 1 for "That," read "Those."
144 14 col. 2 for "gas," read "gauze."
147 29 col. 1 for "larger," read "large."
30 for "smaller," read "small."
47 for "it does not consist," read "it consists."

"Mr. Nutt's work on Bees vindicated from the criticisms of J. P. T. By Mr. Abraham Booth," in our next.

Communications received from Mr. Messiah—Mr. Bagster—Mr. Byrne—R.—P. G.

The Supplement to Vol. XX., with a Portrait of William Symington, is now ready, price 6*d.* also Vol. XX., complete, in boards, price 8*s.*

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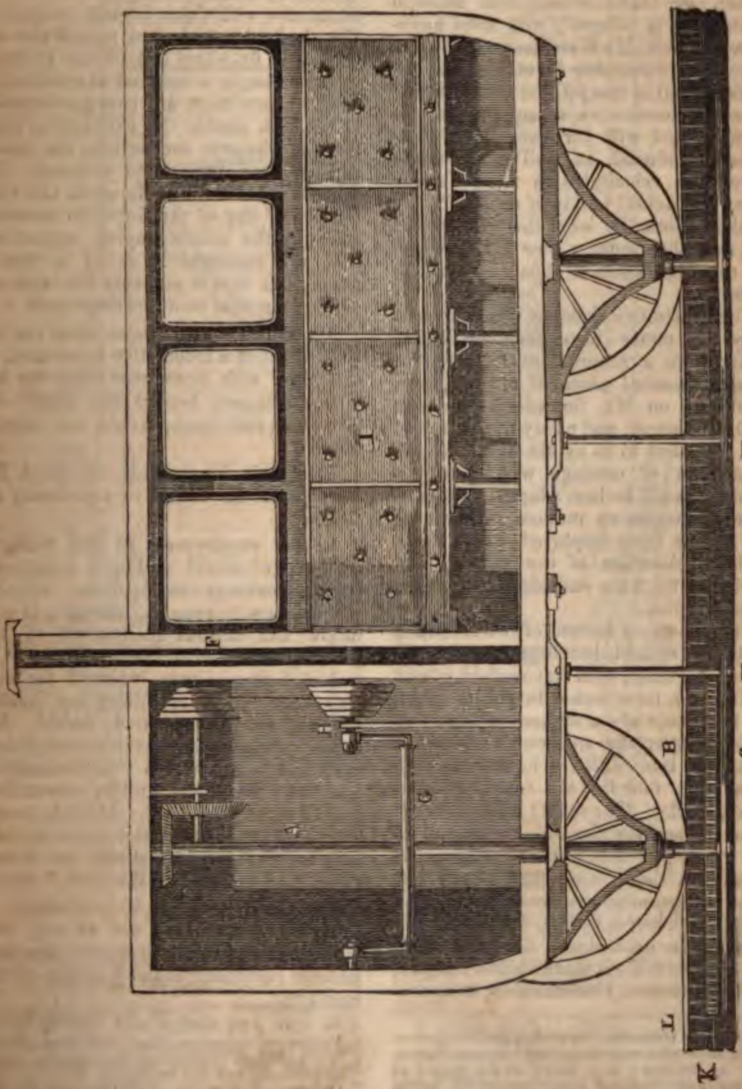
Fig. 1.



SNOWDEN'S RAILWAY-CARRIAGE.

SNOWDEN'S RACK-RAILWAY.

The attention of the public has been earnestly invited, by a printed pamphlet, from the pen of John Ward, Esq.,* to the merits of a plan of railway conveyance patented several years ago by Mr. Snowden, the agricultural implement-maker, of Oxford-street, but hitherto treated (as is alleged) with most undeserved neglect. Mr. Ward asserts that "Mr. Snowden's admirable invention may be fearlessly put in competition with the most approved locomotive steam-engine and railway, and will far excel any thing hitherto produced, as well in respect to power and velocity as in regard to expense and actual outlay of capital." We shall first describe what these inventions are, and then inquire how far they justify the high opinion thus expressed of them.

The illustrative sketches which accompany this notice have been made up, partly from a personal examination of an experimental piece of railway, now exhibiting on Mr. Snowden's premises in Oxford-street, and partly from a drawing, furnished to us by Mr. Ward, of the description of carriage which, in his opinion, would be best adapted to such a railway, supposing manual power to be the motive force employed. Fig. 1 is a sectional elevation of the railway and carriage; fig. 2 an end elevation; fig. 3 a ground plan.

The railway is formed of two side-rails resting on suitable bearings, and properly braced together, with flat surface plates (L L), each three inches in width. Along the inner side of *one* of these rails, immediately under the surface-plate, runs a rack (K), into which a horizontal cog-wheel (B), four feet six inches in diameter, works. The shaft (A) of this cog-wheel passes up through the centre of the working section of the carriage; and beneath it there is another wheel, but *without cogs*, attached loosely to the same shaft, which serves to keep the cogged one at the proper pitch-line. A second wheel (D), similar to C, is placed below the part of the carriage (I) intended to be appropriated to passengers, in order to prevent the possibility of its slipping off the flat rails (L L). A winch (G), worked by men, who may be seated as in rowing, which is well known to be the most favourable position for the application of human strength, sets in motion two pulleys H H, which, by means of the wheel-work in connexion with them, impart rotation to the shaft (A), and thus propel the carriage. A fly-wheel (F), of the ordinary construction, is introduced to equalise the motion; and there are two guide rollers (E), which enable the carriage to adapt itself to whatever inequalities the line of railway may happen to present. The wheels (as there is no flange to the rails) may be of any of the forms in common use: in the accompanying engravings they are represented as of a conical shape, but that is probably the least advantageous that could be employed.

Mr. Snowden calculates that the entire weight of a locomotive apparatus, on this plan, with accommodation for sixteen passengers, besides the hands employed at the winch, would not exceed 18 cwt.

The particular grounds on which Mr. Ward rests its claims to superiority are these:

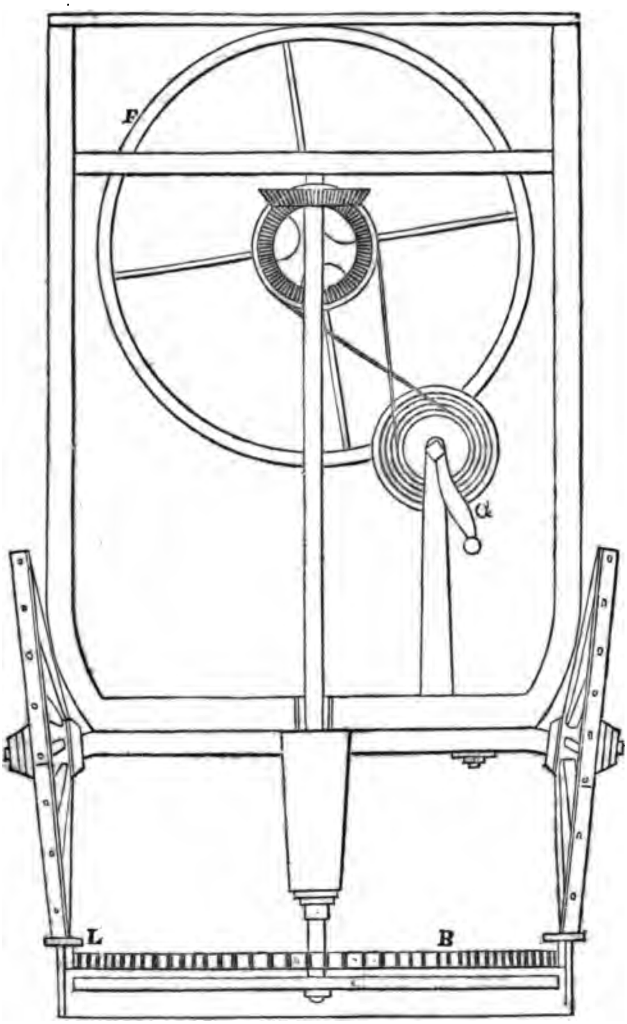
1. The employment of the rack-rail and cogged-wheel makes it (comparatively speaking) unimportant whether the railway is even or uneven; it may follow the natural inclination of the ground; and hence there will be "no wasteful expenditure incurred for cutting down hills, or filling up hollow ground, to the required level." Mr. Snowden's inventions have accomplished what has been hitherto "unsuccessfully sought by the public, and in vain endeavoured to be achieved by scientific men." The expense of constructing the railway will be reduced, in short, to "little more than the cost of the iron," and of the ground required to be purchased.

2. The rails being flat at top, and without flanges, would oppose the least possible resistance to the progress of the carriage.

3. The first cost of the carriage—remembering always that manual power is to be the motive agent employed—"instead of being 1,000*l*., as is the case when steam is used, would not ex-

* A New Discovery, whereby Manual Labour can be most advantageously substituted for Steam-power on Railways, &c. Being an Exposition of the Merits and National Importance of Mr. Snowden's Patent Improvements on Railways and Carriages. *London: E. Wilson, 1834.*

Fig. 2.



eed 100*l.*, and the wear and tear would be comparatively trifling."

4. "In gaining the purchase by means of the grooved or rack-rail, and the horizontal cogged-wheel, the power, if given by manual labour, can at all times be regulated and apportioned to the exact force *required, or in proportion to the weight of goods or number of passengers* to be conveyed—thereby greatly lessening the general annual expenditure."

5. Passengers could be conveyed with a remunerating profit by this plan, at the rate of twenty miles an hour, for one penny per mile each, and goods at about five farthings per ton per mile; while the Liverpool and Manchester

There is an account of these experiments to be found in the "Scots Magazine" for 1788, which it has been allowed was drawn up by Taylor himself. He acknowledges, in this statement, that the merit of the expense of trying the experiment was due to Mr. Miller, but that the engine used upon the occasion was the sole invention of Mr. Symington; and throughout the whole account he never introduces his own name, either directly or by implication. The notice alluded is subjoined.*

In 1789, Taylor is represented as being located at the Carron Iron Works, for the purpose of superintending the castings of an engine of increased size, the cylinders being 18 inches in diameter. But, in opposition to this, we have the affidavit of Mr. Stainton, one of the managers of these works, who states, that—

"He (Taylor) was never considered capable of superintending the work; that he never furnished a single drawing or model by which the work might be forwarded; but that, on the contrary, Mr. Symington was looked up to as being the person to whom all the necessary inquiries, for the completion of the engine, were to be addressed; and that so far from considering Taylor as a principal, he was rather looked upon as a spy appointed by Miller to watch Symington's conduct, that he did not waste too much of his time upon some experiments he was conducting at the same moment for the Wanlock-Head Company."

The experiments with the new engine succeeded entirely; but when it had arrived at that point, that by a little more exertion it might have been perfected, Mr. Miller's excitement was over. He had been bitten by an agricultural mania, dismantled the steam-boat, and left steam-navigation to be promoted by other hands.

In 1801 and 1802, Mr. Symington renewed his experiments, under the patronage of Lord Dundas, that nobleman having purposely gone down from London to engage him. He continued them until 1803, when he completed a steam-tug, which towed two merchant vessels 19½ miles upon the Forth and Clyde canal, against the wind, in the presence of many spectators. Mr. Symington took out a patent in the usual way for the protection of his invention in 1801; and this fact must dispose of the charge of his having practised any concealment, or secrecy, with regard to the matter.

A letter has been published from Mr. Symington to Taylor, in which the former promises to make over half the profits of the invention to the latter. This originated, I am told, in a representation made by Taylor, that he was possessed of considerable influence amongst noblemen and members of parliament, through whose intercession a parliamentary grant might be obtained. But even supposing Mr. Symington was not entitled to the honour of being the first applier of steam to the purposes of navigation, Taylor, from his own showing, and from that of his friends, must have still less claim; for, he states, that he (Taylor) called upon *Mr. Miller*, and endeavoured to persuade *him* to secure the right to the invention by a patent. If it was Miller's invention, Taylor's regretting his own incapability of securing the right by patent is an absurdity.

Taylor's real friends cannot be very much obliged to Mr. Chambers for his biography, for it certainly exhibits him in any thing but an amiable point of view. We find him, in the first place, acting as a spy upon his intimate friend Symington, and afterwards engaging in a secret correspondence with his patron Mr. Miller's most intimate friends, for the purpose of robbing him of the fruits of his experiments, by taking them away to a foreign country; and this he did, after having vainly endeavoured to make Miller as dishonest as *he* wished to be, in taking out a patent to secure to himself the profits of another man's genius.

If Mr. Symington had not expended his private fortune previously to 1815,

* "On October 14, a boat was put in motion by a steam-engine, upon Mr. Miller of Dalswinton's piece of water at that place. That gentleman's improvements in naval affairs are well known to the public. For some time past his attention has been turned to the application of the steam-engine to the purposes of navigation. He has now accomplished, and evidently shown to the world, the practicability of this, by executing it upon a small scale. A vessel, twenty-five feet long and seven broad, was, on the above date, driven, with two wheels, by a small engine. It answered Mr. Miller's expectations fully, and afforded great pleasure to the spectators. The success of this experiment is no small accession to the public. Its utility in canals, and all inland navigation, points it out to be of the greatest advantage, not only to this island, but to many other nations of the world. *The engine used is Mr. Symington's new patent engine."—Scots Magazine, Nov. 1788, p. 566.*

long familiar to engineers. It formed the most striking feature of Blenkinsop's railway carriage, patented as far back as 1811; was strongly advocated by Mr. Gray of Nottingham, in his "Observations on a General Iron Railway," published (if we recollect rightly) about 1818; and, when treating ourselves of the subject of railways, in our Journal of the 21st May, 1831, we observed (page 190):—"For the conveyance of great weights the rack-rail must manifestly have an immense advantage over every description of plain rail; no gripe by mere adhesion of surfaces can ever match the gripe of a good set of teeth." We readily concede, however, to Mr. Snowden the merit of devising a better *mode* of turning the rack principle to account, than either Blenkinsop's or any other with which we are acquainted. It is very simple, and we make no doubt would answer well in practice. We must be understood, however, as limiting the advantage to be derived from it to cases where considerable heights have to be surmounted, which could not be levelled but at a great expense; for wherever railways can be made without difficulty, and at small cost, perfectly level, we hold that, both as regards passengers and goods, the plainer and smoother they are the better. There is no desirable degree of speed or power which may not on a level railway be obtained by simple adhesion alone.

2. The flatness of Mr. Snowden's rails at top, and the absence of flanges, are advantages certainly; but more than counterbalanced, we apprehend, by the increase of friction, occasioned by the rack and cogs.

3. The saving in the original cost of the carriages, and in the wear and tear, would no doubt be very great.

4. That manual force could be more conveniently increased or diminished than steam power, according to the load to be conveyed, or degree of speed required, is also quite certain. The engine of a steam-carriage remains constantly the same—so far as regards all the capital expended upon it—though the quantity of work required from it may often vary; but in the case of Mr. Snowden's carriages, the number of hands employed might vary with *every trip*, and every *change in the load.*

5. Mr. Ward's calculations of the rates at which he could profitably convey passengers and goods on Mr. Snowden's plan, appear to us to rest on very imperfect and unsatisfactory data. Is it on a level, or on an inclined plane, that he expects to realise his twenty miles an hour? He does not say. If it be on an inclined plane, what is the degree of inclination on which he calculates? Or does he consider the force required to be the same for all inclinations? We do not know where he could find the materials for such a calculation, as regards rack-railways, and rather suspect that he has drawn on his fancy, entirely, for the one with which he has favoured his readers.

6. The absence of smoke and of danger are indisputable recommendations.

7. But, with respect to the splendid vision with which Mr. Ward concludes —employment to all the unemployed— plenty for all who choose to earn it by honest industry—an end to over-population and pauperism — another golden age, in short, brought about by "Mr. Snowden's inventions"—we are sorry to be constrained to say that it is, to our thinking, altogether chimerical. That "*fast travelling* can be attained much more economically by manual labour than by steam-locomotion," is a mere dictum of Mr. Ward's, resting on no authority whatever, and contrary not only to all experience, but to all probability. Besides, if such were really the case, manual labour would not possess this superiority on rack-railways alone, but on railways of every description, and most of all on a plain railway, where there is neither cog nor rack. If ever profitable labour is to be obtained for all our unemployed, it will not, at least, be by means of any thing peculiar to "Mr. Snowden's inventions." It is but fair, however, to add, that it is putting these inventions not quite in a just light, to represent them as deriving their chief value from the facility which they afford for the employment of our idle hands in carriage propelling; for a railway and carriage, on Mr. Snowden's plan, could be worked by any other motive power as well as by hand, and probably to more advantage with the help of a steam-engine than in any other way.

RAILWAY SYSTEM.

Sir,—As the railway scheme is gradually advancing, perhaps you will allow me, from time to time, a little room in your Magazine, to continue my remarks on a subject that must eventually attract the attention of every nation.

It is much to be regretted that the spirited individuals of Liverpool and Manchester (who were the first to take up my plan of railways, although they did not think proper to adopt the cog-railway system) should impose such heavy charges and rates of fare, for I am persuaded that one half of their present rates would be more than sufficient to remunerate the shareholders; indeed, it is my humble opinion, that the traffic along the railway would be more than doubled by a judicious reduction of rates and charges.

Pray, sir, do the proprietors of the canal, running between Liverpool and Manchester, hold any shares in the railway? And if any, what proportion? It appears that some undue influence on the part of individuals interested in the canal or turnpike-road must be at work, to the great prejudice of the railway; otherwise, I am sure the canal could not get one ton of merchandise in a month.

As the original projector of the system, you may be sure that I am particularly anxious about the success of my darling scheme, and therefore I cannot tolerate any underhand measures which interfere any way to detract from the merits of railways. To the mismanagement of the Liverpool and Manchester railway, and to the exorbitant charges thereon, may be attributed the lukewarmness of the public to the further progress of the system.

If the Liverpool and Manchester Railway Company shall still persist in demanding those high fares and rates of carriage, the time is not far distant when a new company, on improved principles, will take the field. Indeed, the leading merchants and manufacturers, who are daily transmitting merchandise to and from Liverpool, will soon find that, by competition, one half of the present charges may be economised.

Ever since the publication of my work in 1820, on a general or national iron *railway system, I have regularly* every year memorialised Government, in the hope of drawing the attention of ministers to the subject, as I feel fully confident that from this scheme funds may eventually be raised to defray the general expenses of the state, besides setting apart each year a certain sum for the gradual liquidation of the national debt. When public attention shall be drawn to the scheme, through the influence of Government, it will soon be admitted that the million upon million, now thoughtlessly thrown away every year upon our miserable and contemptible three-fold system of conveyance — turnpike-roads, canals, and coasting vessels—may be in a very considerable degree economised. The national debt, and all our state expenses, are a mere feather in the scale, when compared with the sums of money annually squandered in this country on animal power.

I am, sir,
Very respectfully yours,
THOMAS GRAY,
Author of "Observations on a General Iron Railway."

No. 143, Fore-street-hill, Exeter,
May 28, 1834.

REMARKS ON THE RIVAL CLAIMS TO THE INTRODUCTION OF STEAM NAVIGATION.

Sir,—It must be evident to every one, that not only England, but the whole of the civilised world, is under immense obligations to the individual who first rendered steam available to the purposes of navigation. Public opinion, however, seems still to vibrate between the conflicting claims to this honour put forward by the late William Symington, Mr. Miller of Dalswinton (or rather by his representatives on his behalf), and Mr. James Taylor. As to those of Fulton and Bell, they seem, according to common consent, to be wholly untenable.

We will, if you please, begin "wi' the laird" first. Mr. Miller was a man of property, possessed of an active mind, which was constantly requiring excitement. He was, therefore, always ready to enter into any experiments which promised to afford him that mental stimulus congenial to his feelings. He was, consequently, very ready to assist with his patronage young men who possessed

inventive genius, or supposed that they were so blessed, and of course was very commonly disappointed. As he was easily induced to begin experimentalising, he was just as apt to quit it without carrying it on to a successful result. For, although not deficient in wealth, he lacked that spirit of perseverance, from which alone success can emanate.

Taylor was a tutor in this Mr. Miller's family. He had been on terms of intimacy with William Symington when at the University of Edinburgh, and had seen a model of an improvement which Symington (though then still a very young man) had just perfected in the steam-engine. In consequence, it would seem, of some mention made to Mr. Miller of Symington (very probably by Taylor), Mr. Miller early in 1786 called upon Symington, who was then in the employment of, and residing with, Mr. Gilbert Meason, the manager of the Wanlock-Head Mining Company, and after conversing with him for some time engaged him to make some experiments, for the purpose of ascertaining the practicability of propelling boats by steam. Miller himself had, previously to this, attempted to move boats by means of wheels, set in action by treddles—a plan which he was compelled to abandon from the excessive fatigue it occasioned to the men employed. This scheme, by the way, had not even the charm of novelty to recommend it, for it had been practised by the Romans, who used oxen to work machinery; and also by Savary who had, like Mr. Miller, exerted human force for that purpose.*

The biographer of Taylor, in "Chambers's Journal," states that he "attended the University of Edinburgh for several years;"—that the classes selected by him were anatomy, surgery, and chemistry; and that he "prosecuted his studies with much assiduity and success, for at the end of his course he was prepared to enter *either* upon the profession of medicine or divinity"!! Now, if the College Album be an authority to be confided in, Taylor matriculated for *one* season only, and attended the classes above mentioned for one course each. "One swallow," says the adage, "does not make a summer;" but, according to Taylor's biographer, one course of lectures fully qualified him to be either a physician or divine! I make no doubt that he was just as well qualified for the one as the other—that is, not at all. I agree with the writer in "Chambers's Journal" that his genius was excursive, and that to a very considerable extent, but I have yet to learn that its excursions were ever attended by any beneficial result. He is said to have had a predilection for mineralogy, geology, and mechanics; but if this were true, how comes it that Taylor, being at the university where those subjects were treated upon scientifically, never availed himself of so excellent an opportunity of attending the classes in which they were taught?

The improvement in the steam-engine, devised by Mr. Symington, was accomplished in 1785-1786; and it was in the spring of 1786 that Mr. Miller, as already mentioned, engaged him to carry on some experiments upon steam navigation. These were made upon the lake at Dalswinton, Mr. Miller's property, in 1788. It is asserted that Mr. Taylor remained in Edinburgh, after Mr. Miller had left, to superintend castings of the parts of the engine intended to be employed in moving the boat. But if this were necessary, why did not Taylor afterwards put the engine together? If he were capable of furnishing the drawings and models by which the various parts were to be constructed, surely there could be no necessity for sending for Mr. Symington from the Lead-hills to put the different pieces properly "*in situ.*" Mr. Miller would have been little less than mad to employ Symington in these experiments, when he had such a brilliant and inventive genius as Taylor residing under his own roof. If (as has been asserted) Taylor was the author of these experiments, where are the drawings and documents to substantiate his claim? Have they ever been seen by any person? Or, indeed, have they ever existed, except in the imagination of his partisans?

* Mr. Miller seems to have had a predilection for appropriating other person's inventions to himself; or, if *he* had not, his friends have endeavoured to do so for him, as they would willingly have us to believe that the piece of sea-ordnance, known as the Carronade, was the fruit of Mr. Miller's genius, when, in truth, it was invented by Mr. Gascoigne, one of the proprietors and managers of the Carron Iron Works, *from which circumstance it derived its nam*

logic, as he appears to have discovered that the proofs of the advantages of a system are not found in facts; and that if by this method the bees secrete a larger quantity of honey, and that of a quality far purer than can be obtained by any other mode, this is no sign of the superiority of the management, or the prosperity of the hive. And, after all, how does it appear that he has made the notable discovery, that the Malthusian practice of the bees is not consonant to their wishes, but unnaturally forced upon them? Not, it appears, from his having ever essayed any thing relating to Mr. Nutt's system, the failure of which might justly lead him to doubt its merits and practicability. As he is such a stickler for nature, I would ask, would it not be more congenial to nature, were he not to deprive the bees of their treasures at all, but leave them to be consumed and enjoyed by them entirely? To argue against the value of the system on such grounds is preposterous, when it must be accorded that the only substitute for Mr. Nutt's system, and securing to nature the efficiency of her plans and operations, and giving to man those treasures which the insect as well as the animal world were designed to yield to him, is in the very unnatural practice of the destruction of the whole of the stock.

I am sorry that time does not now permit me to follow J. P. T. in his details, but which I shall do at a very early opportunity. I am glad in this, for the opportunity which will be afforded me to do better justice to it from an inspection of Mr. Nutt's apiary, as well as that I shall be favoured by the assistance of my friend the Rev. T. Clark, who, although coupled by your anonymous correspondent, in his sweeping charge of impiety, with Mr. Nutt, is a proud ornament to his profession, from the discharge of his duties as a man and a clergyman.

I remain, sir,
Your obedient servant,
ABRAHAM BOOTH.

London, June 4, 1834.

HINTS ON DRAWING ISOMETRICAL PERSPECTIVE ON WOOD.

Sir,—As the publication of Mr. Jopling's treatise has already effected a change in the manner of representing buildings, &c., in the offices of some of the London architects—and as isometrical perspective will, doubtless, soon become very generally employed in periodicals, for the representation of objects in all cases where it is desirable that the appearance and effect may be shown by the same engraving to which we can apply the scale and compass—permit me to offer a remark or two on drawing this projection on wood.

The manner of drawing on wood generally, and of preparing the blocks, &c., for that purpose, I have explained in vol. xix. p. 341; but to make an isometrical drawing on wood requires more care than is necessary for a geometrical drawing; and the reason that we frequently see little inaccuracies in wood-cuts of objects represented by this method, is partly from the want of care in transferring such drawings to the wood, and partly from the want of a proper instrument for drawing the parallel diverging lines. When an isometrical drawing (say, for example, a farmery,) is made on the middle of a sheet of paper, or, when it is to be copied from the pages of a book, as there is no base line to guide the engraver in transferring it, he, of course, puts it on the wood by his eye; or, perhaps, he makes the upright lines parallel to the block. These lines may, however, be very short, and therefore no proper guide; and even in the event of their being inclined a little (which must be the case when the blocks, which frequently happens, are not exactly square,) in the transfer, it would be, so far as regards these lines alone, of no consequence, as the small steel square would soon put them to rights; but such inclination in the upright lines, however trifling, would make the greatest difference in the angles of the diverging lines; therefore, in transferring isometrical drawings on wood correctly, so that the angles formed by the oblique lines with the lower edge of the block may be the same right and left, the surest way is to raise a perpendicular from the diverging lines, by the assistance of a protractor, and draw a base line at right angles thereto, which latter line must be parallel to the lower edges of the block in transferring.

I hope that Mr. Jopling will agree with me, that, in many cases, neither

the parallel ruler and triangle recommended by him, or the T square and "set" recommended by myself to be used in drawing on paper, are of any use in drawing isometrical perspective on wood; because the drawing comes so near the edge of the block that there is no margin for the parallel ruler to work on, and for the same reason the T square and "set" cannot be applied to the lower part of the drawing. Another block might certainly be placed beside that on which you are at work; but this in practice is but a troublesome way of proceeding. The best instrument for drawing this projection on wood (not on paper) is a light delicate steel square, with a moving blade, and of the form of a joiner's square, or rather the form of a carpenter's bevel. When the blade is fixed by a neat screw at the proper angle, all the lines, however near to the sides of the block, may be drawn without any trouble, and with the greatest facility.

As the manner of representing objects in isometrical perspective will, as before observed, soon be much employed in publications, if Mr. Elliot has not made such an instrument, and thinks it worth while to do so for the use of engravers, I shall be happy to make a drawing of the form which I consider most suitable for the purpose.

I must say, that the publication of Mr. Jopling's treatise has given me a stronger attachment to isometrical perspective than much practice in the method had previously done; and it may be gratifying to the lovers of this projection to know, that, among other instances of its utility being appreciated, when thoroughly known, is the following: —While I was conversing one day with the clerks in the office of an eminent architect, the conversation turned upon the manner of representing objects in an architectural work recently published. These objects (which were in isometrical perspective) they looked upon as being quite ridiculous, and only a failure in an attempt at bird's-eye radial perspective. I, however, undertook to show that the engravings in question were strictly correct, and projected on principle; and to establish this point I sent them the "Practice of Isometrical Perspective," with a *strong invitation to study* it carefully. The next time that I called I was much gratified to find that the book had worked such a change—that the office drawings were now being made in isometrical perspective.

With regard to perspective in general, it is much to be regretted that there is no intelligible work on radial perspective, in which the rules are explained in a simple manner, such as in Mr. Jopling's work on "Isometrical Perspective." It will scarcely be believed, that many of the principal draughtsmen in the offices of architects have been in the practice for years of representing objects in all sorts of perspective, without at all knowing the first principles of the art, or rather method; or without even knowing the meaning of the plane of projection. But this only leads us to the painful reflection respecting the manner of conveying instruction to youth, that it has always been in any way rather than in such a form as to address itself to the reason; and, therefore, we do not wonder at persons thus taught being in after-life mere mechanical machines, operating without ever knowing, or wishing to know, the "why and the wherefore."

I remain, sir,

Yours respectfully,

R.

Bayswater, June 6, 1834.

ON THE ANCIENT AND MODERN PRACTICE OF ENGRAVING AND MULTIPLYING DIES. BY W. WYON, ESQ., A.R.A., CHIEF ENGRAVER TO THE ROYAL MINT.

[From continuation of Report, in the *Athenæum*, of a Paper read by Mr. Wyon at the Society of Arts, 13th May last.]

With respect to the ancient practice of engraving and multiplying dies, we have very little information handed down to us, and as the coins themselves attest the employment of very able artists, it is singular that we should be unacquainted with any of their names; there is, it is believed, but one exception, which is found upon a coin of Crete. We are equally uncertain as to the materials with which the dies were made. It is, however, related that ancient dies have been found at different periods; and Count Caylus mentions that one came into his possession, which was composed of copper, tin, zinc, and lead, in equal proportions. But

Mr. Wyon stated that he was not aware of any compound of these metals capable of resisting the force of the blow necessary for making a perfect impression in the metals used for coinage. An ancient die found at the temple of Nismes, probably of the same materials, was submitted to a blow of the coining press in the French Mint, and thereby broken to pieces. Mr. Wyon, indeed, had not the least doubt that iron or steel was employed for this purpose, as it was not unknown to the ancients.

The mode of striking their monies must have been extremely simple, and the instruments used for this purpose, are probably to be seen on a coin of the republic—it has on the obverse, the head of a female, with the inscription "Moneta," and on the reverse the pincers, the hammer, and the anvil. The metal he conceived to have been cast in a globular shape, and having been placed between two dies, the upper one was struck with a hammer. We have evidence of the blow being repeated, by the appearance of their coins: they are frequently what is technically called double struck—this occurs when the piece has slipped out of its place after the first blow, and a repetition of the blow causes a double outline to appear.

Mr. Wyon now described our present mode of engraving and multiplying the dies.

The selection of the best cast steel for the purpose, he observed, was very important, and not sufficiently understood at present. The very fine steel that forms excellent gravers and other cutting instruments, is unfit for the purpose, for unless hardened with great care, it is very liable to crack. The very coarse steel is also objectionable, as it acquires fissures under the die press. The object therefore is, to select steel of a medium quality—but the best steel may be spoiled, by want of skill in the smith who forges the dies.

When the rough die is brought to a table in the turning lathe, after being softened, the engraver commences his labours, by working out the device with the small tools in intaglio (sunk in), and when he has completed his work, the die is ready for hardening, which is in itself a very simple process—but one that is often attended with serious disappointment to the engraver, for it not unfrequently happens, that the labour of many months is esther injured or utterly destroyed, from the steel itself being faulty or heated to excess. But supposing the original die, or, as it is technically called, a matrix, to be uninjured by the process of hardening, it is reserved for the purpose of furnishing a puncheon (or a steel impression in relief). *For this purpose* a block of soft steel is *turned flat at the bottom* and obtusely conical *at the top*. In this state, its conical surface is compressed into the matrix by a blow from the multiplying die press; this gives us only the commencement of an impression, for the die becomes so hard from compression, as to require frequent annealing and re-striking before it is perfected. An impression taken in this way is called a puncheon, which, when the engraver has given to it all the delicacy of finish existing in the original, is then hardened, and serves for the purpose of making dies for coining, by a similar process, viz., impressing the hardened steel into that which is soft.

The distinction, said Mr. Wyon, between striking medals and coins, is very essential, so much so, that I cannot avoid saying a few words on the subject. A medal is usually engraved in high relief, like those upon ancient coins, and it requires a succession of blows, sometimes forty or fifty, with repeated annealings, to make a perfect impression. A modern coin, on the contrary, is usually brought up with one blow, although with the disadvantage of the metal being harder. Standard gold, for instance, consists of one-twelfth of alloy; medals are usually made of fine gold; the engraving upon the coin is consequently made with a suitable degree of relief.

In striking a coin or medal, the lateral spread of the metal, which would otherwise ooze out as it were from between the dies, is prevented by the application of a steel collar, accurately turned to the dimensions of the dies. The number of pieces which may be struck by one pair of dies, not unfrequently amounts to between three and four hundred thousand, but the average amount is much less. Mr. Wyon stated that he remembered instances of twenty dies being destroyed in one day, owing to the different qualities of steel, and to the casualties to which dies are liable. There are, it appears, eight presses in the coining-room of the Mint, and he considers that the destruction of one pair of dies for each press per day, is a very fair proportion, though it is generally rather more.

It must be remembered, that each press produces sixty pieces per minute, without reckoning the stoppages occasioned by changing of dies and other contingencies, and Mr. Wyon remarked, that in 1817, the daily produce of coins, in half-crowns, shillings, and sixpences, amounted to the enormous quantity of 343,000 per day, for three months: at that time all the eight presses were employed; but on the 1st of last April, there were 125,000 pieces coined with five presses only. From the 4th of June 1817 to the 31st of December 1833, there were coined in sovereigns and half sovereigns, 52,187,265*l.* sterling.

Mr. Wyon then proceeded to give a short account of modern medals, which in many

form an equally interesting study, of the ancients. On them we find r sea and land, processions, corona- ieral pomps, and other ceremonies, , marriages, portraits of illustrious l all that relates to policy or religion. e rarely omitted, the absence of ancient coins and medals causes so ncertainty. There is also another ance that materially contributes to ure to be derived from the study of medals, which is their proximity to time, and their recording great with which we are in some degree acquainted.

ng the term modern, as applied to ject, it is generally understood to all those medals since the time of iagne or the commencement of the entury, and it is curious to observe mate connexion between literature study of medals; for we find one of iest writers (Petrarch), forming a n, and recommending them to IV. as fit objects for his study and ilation, and with a plain sincerity lid him honour, requesting the em- o imitate the great men thereon ed.

n not aware (continued Mr. Wyon) of tence of modern medals, of any im- e, previous to the revival of the art fifteenth century, that is to say, in and then the art was principally in ids of painters, amongst which we e names of Pisano, Boldu, and Pisano is celebrated as the chief re- of this branch of the art, and his are usually inscribed 'Opus Pisani s;' we have one of his, of Ferdinand, f Arragon, 1449, and another of John, or of Constantinople, ten years before. medals of this period are very unlike cient ones, being very large. They reviously modelled either in clay or cast from which being obtained in it was carefully repaired, removing all perfections of casting, and giving a degree of finish than could be ob- in the original model. This then be- pattern, from which all the subse- medals were cast; a slower mode of ling, and one preventing that rapidity tiplication which we possess in the use . The medals, however, thus pro- frequently present more vigour of ion; the heads upon them are very or to their reverses."

most ancient series of modern medals from dies, is the Papal. We have porary portraits of Popes from Paul II., to the present time. There are, in- *papal medals from* Martin V., 1417, *those before Paul II.* were executed during the pontificate of Alexander VII., 1655; by the care and under the direction of Abbé Bigot. The medals from the time of Alexander VI. are very fine, and it is said, that the designs upon some of those, during the pontificate of Julius II., Leo X., Hadrian VI., and Clement VII., are by great masters, amongst whom were Raffaelle and Julio Romano. Benvenuto Cellini informs us, that he executed several medals of Clement VII. Cavino and Bassiano, the celebrated forgers of Roman imperial coins, executed the medals from Julius III. to Gregory XIII. About the time of Innocent X., the very extraordinary family of artists, the Hamerani, appeared. They executed the papal medals for four or five generations, with great ability; even one of the daughters engraved an excellent medal; and some of those by Gaspar Molo are very fine. The pontifical dress imparts great richness to the portraits, and the reverses are often very elaborate; sometimes twelve or fourteen figures are crowded together in the representations of religious ceremonies, within a space considerably less than a crown-piece. Perhaps, said Mr. Wyon, I ought not to omit mentioning the medal of Julius III., on the occasion of Mary of England restoring the Roman Catholic religion in this country.

Next to Italy, France is the most remarkable country for medals; Louis XIV. is celebrated for his encouragement of the fine arts; he founded L'Académie des Inscriptions, for the purpose of selecting subjects and making designs for medals, to commemorate the great events of his reign. The result of the labours of the Academy was the production of nearly three hundred medals. The style of art exhibited in these, was in accordance with the taste of the period—it wants simplicity. Landscapes and a variety of emblems are crowded together in the back-grounds, for the purpose of giving a picturesque effect, which is injurious—the resources of the art being limited in comparison with those of painting. Mr. Flaxman's remarks were considered by Mr. Wyon as particularly applicable to his subject, where he says of the limited powers of basso-relievo, "that a tree or two, some rude stone, or a wall slightly marked in the back-ground, must indicate a forest, a mountain, or a palace, without detailing a portrait of their component parts."

Napoleon, said Mr. Wyon, well understood the moral and political influence of the fine arts; his series of 160 medals is an evidence of the care and attention he bestowed upon the Mint, and these imperishable memorials will give immortality to his extraordinary career. They were executed under the direction of Denon: on the obverse of all of them we have the fine profile of Napoleon, and

many of the reverses are admirable works of art. The battle of Jena, Jupiter launching his thunder against the Titans, Mars sheathing his sword after the battle of Friedland, Napoleon personifying Hercules, with two female figures kneeling, and presenting him with the keys of Vienna and Presburg, may be mentioned as examples: but for the most part they rather astonish us with a display of mechanical execution; the large medal of the battle of Marengo is surprising for the minuteness of the workmanship; and the medal of Pope Pius VII., in the coronation of Napoleon, is also remarkable for the execution of the building of Notre Dame on the reverse. Andrieu, Galle, Droz, and Brenet, were some of the most celebrated artists employed. But the Napoleon medals are not always implicitly to be relied on by the historian; as an instance, Bonaparte caused a medal to be struck on his intended invasion of this country; on the obverse, as usual, is the head of the emperor, and the reverse represents Hercules strangling a marine monster, around is the legend "DESCENTE EN ANGLETERRE," and in the exergue "Frappé à Londres." Happily for us, this was struck in anticipation only. This medal was afterwards destroyed; some few specimens, however, escaped, but they are excessively rare.

Under such high auspices the art is recommended to and encouraged by the public, and individuals begin to pride themselves on their medallic taste, and not unfrequently adopt this mode of giving permanence to matters interesting to their feelings. It is not unusual, for instance, in France, for a medal to be engraved on the event of a marriage, with portraits of the hymeneal votaries, or with their names inscribed upon them, and some emblems of the happy event. Russia, Prussia, and Sweden, have emulated France in this passion for numismatic records.

Mr. Wyon then adverted to the fact, that in our own country, on the contrary, with the exception of a few coronation medals, scarcely any have been struck by authority of the Government. But notwithstanding this neglect, the enterprise of individuals has produced many interesting medals, which show the spirit of the times in which they were executed.

The first contemporary English medal is of Sir John Kendal, in 1480, and of Italian workmanship. We have a gold medal of Henry VIII., date 1545. Mr. Evelyn remarks, that in this medal Henry appears in his usual bonnet, furred gown, and an invaluable collar of rubies. The first coronation medal of England, is the one of Edw. VI.: it is of very indifferent workmanship, and in low relief. There are several beautiful medals by Trezzo, of Philip and Mary, and many curious ones of Elizabeth, on her accession to the crown, and the defeat of the Spanish Armada in 1588. The medals of Elizabeth are generally cast, and have highly raised borders richly embossed: during this reign, too, we have some exquisite medals by the famous Stephens, of Holland;—and Mr. Wyon expressed a doubt whether there are any works superior to them for style in art: the admirable manner in which the flesh is treated, in distinction to the hardness of bone, in the face, could not, he said, be sufficiently studied or admired by the medallic artist or amateur; the reverses, however, are not equal to the heads. All the medals by Stephens are exceedingly rare.

The history of James I. is tolerably well preserved in medals; they generally, in style, resemble those of Elizabeth; but there is a very good one by Warin, of Sir Thomas Bodley, founder of the Bodleian Library at Oxford. In the early part of the reign of Charles I. we have many counters struck on his marriage. The medals of this unfortunate monarch, Mr. Wyon observed, are numerous, many of which were engraved during the time of Charles II. by the Roettiers.

Cromwell was fortunate in having excellent artists. The two Simons executed all the best medals; Abraham was a modeller, and there still remain in the British Museum many excellent models in wax by him; they were generally cast in silver, and some of the best were left untouched from the casting, but others were admirably chased and repaired by Thomas Simon. The great merit in these works, is the characteristic expression of living nature; other artists have been more correct, but often coldly correct, as compared with the Simons. A large oval medal, struck in gold, was presented to Admiral Blake, after the engagement with Van Tromp in 1653. The history of it was traced in a satisfactory manner till it came into the possession of Mr. Trattle; his present Majesty having heard of the circumstance, and feeling a deep interest in the naval glory of our country, gave a large sum for it, and the medal is now in his collection. Of Charles II. there are several good medals.

Many medals occur of James II., both before and after his abdication; and the events of the reign of William III. called forth many interesting medals,—the Dutch ones extend even from his infancy. The medals of Queen Anne are not only interesting as works of art, but particularly so as recording the great events with which Marlborough illuminated her reign.

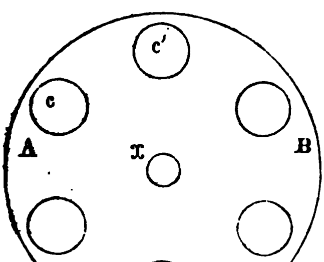
About 1730, John Dassier, a native of Geneva, settled in London, and engraved a series of medals of the Kings of England: they would be more valuable if the portraits could be relied on. He also execute a set of

small medals of the Reformers, and commenced a series of our great men. His nephew, James Antony, who on Croker's death was appointed second engraver to the Mint, engraved several others. The character of workmanship of both the Dassiers, notwithstanding their industry and ingenuity, was that of extreme hardness and precision of outline; still there are very clever medals by them, and they evince an advance upon the state of the medallic art of that period.

THE MAGNETO-ELECTRIC RING.

(Addenda et Corrigenda.)

Sir,—If this should arrive in time, may I beg you will have the goodness to insert the following figure in place of the one representing a disc divided into alternate sectors, and forming a part of my communication respecting the mode of applying to permanent magnetism my new mode of developing the magneto-electricity.*



A B is a plate 1 foot or more in diameter, about ½ an inch thick, and made of fine brass. C C, &c., are pieces of the best soft iron, annealed and set into the plate A B, so as to be in the plane of its surfaces. X marks where the axis is inserted into the plate. The pieces of iron are circular, or of whatever shape may accurately correspond with the transverse section of the members of the magnetic circuit, between which the plate works.

As an additional inducement to the construction of the ring, or other apparatus on a large scale, I should have suggested, that there appears every reason to expect that, when the apparatus is increased beyond a certain size, the quantity of electricity disturbed by the galvanic reverser will be sufficient to force its way through an interval in the circuit; in other words, that a striking distance will be established, and so the central disc be dispensed with. This relief would be of great importance in the method I have proposed with permanent magnets, because it would render unnecessary the additional mechanism for disrupting the armature poles; and in the ring apparatus, because it would avoid an inconvenience to be anticipated when the electrical development should be very powerful, namely, the incandescence and destruction of the spring which presses on the limb of the central disc.

I am, sir, &c.

φ.

June 6, 1834.

* Our ingenious correspondent will have seen by this time that the article alluded to appeared in our Journal of the 24th May last, ten days before this letter was written.—Ed. M. M.

[We take this opportunity of pointing out two or three typographical errata in the valuable article to which the preceding communication refers.

Page 114, col. 1, for "bar armature" read "lever armature."
— 115, col. 1, near the top, for "armatures" read "annulus."
— — col. 2, line 7, dele "sort."
— 116, col. 1, line 17, for "spark" read "shock."]

NOTES AND NOTICES.

Captain Ross, in the evidence given by him before the Select Committee of the House of Commons appointed to inquire into the circumstances of his last Polar expedition, asserts that there is a difference of altitude, between the two seas east and west of Boothia Felix, amounting to thirteen feet! And he thinks this fact furnishes a strong presumption against the existence of any north-west passage. His nephew, Capt. John Clark Ross, is, however, of a perfectly opposite opinion. He states that he is not aware of any difference in the level of the two seas, and believes a north-west passage will be yet discovered.

Captain Ross (sen.) is now at Copenhagen, where he is said to have gone to make arrangements for an exploratory expedition to the *South* Pole. At the last meeting of the Royal Geographical Society, a communication was read from a Mr. Rea, R.N., giving an account of a South Polar expedition, fitted out last year by Messrs. Enderby, of London, but which totally failed long before reaching the Antarctic seas, in consequence of the loss of one of the vessels on an ice island, in lat. 60° south, long. 57° 30′ west. In Mr. Rea's opinion, however, this was a mere accident, which ought not to discourage another attempt.

A paper, by Mr. Barlow, was read at a late meeting of the Royal Society, in which he gives the result of a number of experiments to ascertain the relative velocities of the Government steamers. It appears from these experiments, that the increase of speed gained by the adoption of vertically dipping paddle-boards is very trifling—so much so,

many of the reverses [illegible]
art. The battle of Jena, [illegible]
his thunder against the [illegible]
ing his sword after the [illegible]
Napoleon personifying [illegible]
female figures kneeling, [illegible]
with the keys of Vienna and [illegible]
be mentioned as exampl[illegible]
part they rather [illegible]
of mechanical execution; [illegible]
the battle of Marengo [illegible]
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medal of Pope Pius VII., [illegible]
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Henry VI[illegible]
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medals [illegible]

[illegible] These phenomena seem to justify the hypo[illegible] in the *Annuaire* of 1832, as to the [illegible] in which he supposes that they [illegible] from the vapours of an immense [illegible] centre of the earth, which have es[illegible] fissures in its crust, or from some [illegible], the smoke of which has been wafted [illegible] one particular direction, or from some [illegible] to our globe, which has burst by its [illegible] fire, or been disruptured by the shock [illegible].—*French Paper.*

[illegible] of the 3d inst., from Rodelheim, near [illegible] quoted in the French papers, says.—[illegible] some heavy showers of rain which fell [illegible] from half-past eleven to twelve o'clock, [illegible] from twelve to one, the water contained [illegible] a mixture of sulphur, that, as it ran down [illegible], it was covered with a yellow crust, and [illegible] of sulphur might be scraped from off the [illegible]."

[illegible] *Silver.*—The solder generally employed [illegible], we believe, of an alloy of the German [illegible] itself with tin. For cleaning, S. D. should [illegible] wood ashes, or ivory black well washed [illegible] sized.

[illegible] the Committee on the Bristol Railway, Mr. [illegible] Walker, C.E., said,—"We are making an [illegible]periment (I believe it is new) upon the Leeds and [illegible] Railway, with the intention of lighting the [illegible] by shafts from the surface, and placing at [illegible] bottom of these shafts, and nearly at the top of [illegible] tunnel, reflectors. The rays of light falling per[illegible]dicularly upon the reflecting medium suspended [illegible] a considerable angle, are reflected into the tun[illegible]. As far as the experiment has gone it has been very successful. The ends of the tunnel have been [illegible]rkened, and a newspaper read in the tunnel by the reflected light."

So intense has been the heat of the sun's rays during the past month, that between two and three P. M., on the 31st, a thermometer, whose bulb was covered with black wool, rose to 130°, with a gentle wind from the south-east, and *cirrus* pre-vailing in the vicinity of the sun at the time. The mean temperature of the external air for May has been nearly two degrees higher than the mean of May for a series of years.—*Dr. Burney's Meteorological Report—Hampshire Chronicle.*

A gentleman in this town (Kirkaldy) has lately received a letter from his son, who is first mate of a vessel now in the Mediterranean, in which he says, —"The vessel is built on Ballingall's plan, and the consequence is, we have never had occasion to touch the pumps since she left England, about two months ago"—*Edinburgh Observer.*

Canine Shower-bath.—A dog may be seen, most mornings, in the neighbourhood of Brunswick-square, enjoying the luxury of a bath at the tail of a water-cart. He watches for the arrival of the cart, and then follows it a considerable distance, bounding and frisking in the jets. It is quite a re-freshing affair to the actor, and to the specta[illegible] also.

Communications received from Mr. De Blaqu[illegible] —R. S.—Momus—Mr. Blackett—Mr. Hallig[illegible] R. (Halifax.)

The Supplement to Vol. XX., with a Port[illegible] of William Symington, is now ready, price [illegible] also Vol. XX., complete, in boards, price 8s.

LONDON: Published by M. SALMON, at Mechanics' Magazine Office, No. 6, Peterboro[illegible] Court, between 135 and 136, Fleet-street. A[illegible] for the American Edition, Mr. O. RICH, 12, Lion-square. Sold by G. G. BENNIS, 55, [illegible] Neuve, Saint Augustin, Paris.
M. SALMON, Printer, Fleet-street.

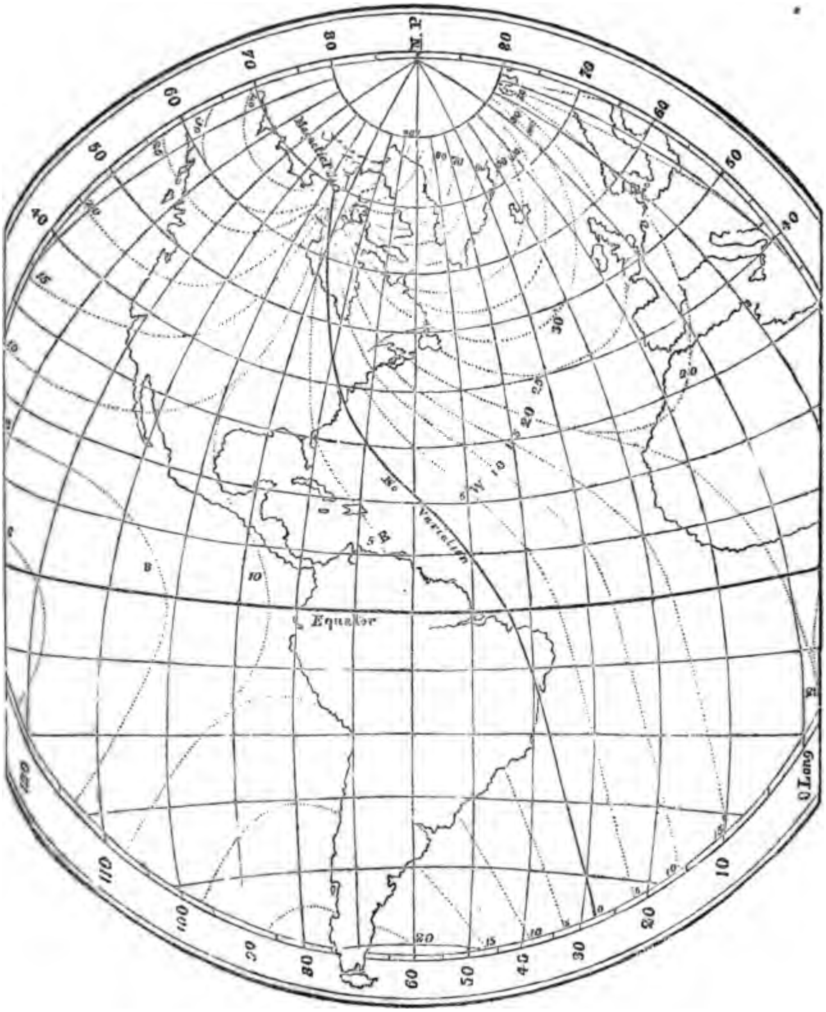
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 567. SATURDAY, JUNE 21, 1834. Price 3*d*.

MAP OF MAGNETIC CO-VARIATION LINES IN AMERICA AND THE ATLANTIC, AND ALSO PARTS OF EUROPE, ASIA, AND THE PACIFIC,

Stereographically transferred from the Circum-Polar and Equatorial-Maps of Professor Barlow.



ABSTRACT OF A PAPER IN THE PHIL. TR., 1833, PART II.; "ON THE PRESENT SITUATION OF THE MAGNETIC LINES OF EQUAL VARIATION, AND THEIR CHANGES ON THE TERRESTRIAL SURFACE." BY PETER BARLOW, ESQ., F.R.S., &c.

[We have been induced to present our readers with the substance of this interesting paper, on account of the very limited circulation which the original Transactions receive, especially those Parts which are charged at a high price. The magnetic lines are, in the original, traced on a circumpolar map of 30° radius, and an equatorial one (Mercator's) extending from 60° N. to 55° S. The author regrets the want of continuity in the curves occasioned by this method, and remarks that they appear to much greater advantage when traced on a real globe. We have *translated* the most interesting portion of his maps into the form suggested by a correspondent of the Mechanics' Magazine (xx. 168), a change which, we imagine, the author will approve, should these pages fall under his notice.]

The author has undertaken the task of collating and arranging all the valuable information recorded in several recent and important voyages and journeys of discovery, conducted by officers of high scientific character, and furnished with instruments of the most perfect description. He particularly mentions the voyages of Captains Beechey and Biscoe, the surveys of Captains Owen and King, the voyages of Lutke (Russ.) and Duperney (Fr.), the materials in the hydrographical offices of Captains Beaufort and Horsburgh; and lastly, the numerous experiments of Commander Ross in the immediate vicinity of the magnetic pole. These, together, formed such a mass of well-authenticated observations, as seemed to render it very desirable to put them into a form for future comparison, if not for immediate investigation.

The author has only laid down such lines* as were warranted by actual observation; the deficiencies exist chiefly about the South Pole, and over lands, except in Europe.

On attentively examining these lines, especially on a globe, the author thinks that, notwithstanding their extraordinary curvatures, they exhibit a dependency on some law, however intricate and mysterious. If the variations were greatly influenced by local causes, we could not expect to find that regularity which is observable in so many, if not in all parts. Throughout the Atlantic, for example, there is a continuity and softness of curvature, and unity of character, quite inconsistent with such a supposition. Again, in the Indian Ocean, we have a most extraordinary inflexion of the line of no variation,* whereby two-thirds of the equator, or 240°, have easterly variation, and only 120° have it westerly. In both cases, the multitude of observations which have been discussed leave no doubt of the correctness of the delineation; and we see no such sudden interruption of curvature as must occur if local causes were very influential.

Another marked peculiarity in the Indian Ocean is, that for 40° the zero line runs nearly parallel to the equator, and therefore 40° down a meridian, whence it follows that the magnetic pole must also range through 40°, or be coincident with the axis; either of which conditions is equally inconsistent with the notion that all these phenomena are due to the action of four or more magnetic poles. Again, referring to the remarkable curves in the great Pacific, there is, notwithstanding their peculiar character, no appearance of uncertain or anomalous attraction; the whole seems to form a system by itself. The lines return upon themselves in similar though not in regular figures: and here again the author can see no possible position of four poles which can lead to such configuration.

The foregoing remarks have reference to the present state of the magnetic lines; but their progressive change of situation

* *In many parts each degree of variation is exhibited by a distinct curve, in others, the multiples of 5° or 10° only.*

* The Asiatic line of *no variation* presents a range of curvature strongly contrasted with the American. In the lat. of 80° N., its longitude is about 37° E. (just at the border of our map). After passing southerly for some degrees, it takes a sweep like the letter S through Asiatic Russia (see Hansteen's Chart, Edin. Phil. Journ., 1821), and comes out at the Sea of Ochotsk; then passing southward through the Sea of Japan it bends westward, touching the N. point of the Isle of Formosa. It must then take another sweep through China and Thibet, for it enters the Indian Sea at the Gulf of Cambay, and crosses the equator in 75° W. lon., and (according to Barlow), after following for 20° the parallel of 10° S., it reaches Vansittart Bay, on the N. coast of Australia. On the S. coast it is found in long. 130° E., and follows that meridian to an indefinite extent. Hansteen's Chart gives it a most incredible sinuosity through the Chinese Seas and among the Indian Islands.

In the Pacific Ocean the variation is wholly eastern, the minimum point being 135° W. long. and 19° S. lat., and its value there less than 5°, and the curves of the several values up to 10° variation, form continuous heart-shaped curves round this centre.

and configuration is another important feature. From some early notices, the author infers that, about the year 1660, the line of no variation must have crossed the Atlantic nearly at right angles to the meridian, as it does now in the Indian Ocean. From that time it has been gradually descending towards the south and west; and at present crosses some way inland on the eastern point of South America.

We have no such early authority for that zero line which passes through Australia; but it seems probable that for the last sixty years very little, if any, change has taken place.

In all known cases, except these two, the motion for some years before and after the passage of the zero line over any spot has been very rapid, whereas in these it is nearly stationary. Thus, in London, the variation in 1580 was 11° 15′ E.; in 1658, zero; in 1698, 8° W., giving a change of 20° in little more than 100 years; and the same is observed in all other places, except the two referred to, where the passage of the line is well determined.

In the West Indies, the Bermudas, and a few other places, where the variation is small, the change has also been very inconsiderable; but the author has found no case where the variation is large and stationary. Churchman first assumed, and the author finds the theory confirmed in all cases where sufficient registers of variation have been made, and where the motion or change has been considerable, that we may always reduce that motion to a certain rotation of an assumed magnetic pole about the pole of the earth.

The author has compared* the actual and computed variation for different periods, at London, Paris, and Copenhagen, and finds the agreement between them very considerable, and he infers that the hypothesis of a polar revolution must be founded in fact. He also accounts for those stationary, or nearly stationary, points of no variation to which reference has been made, by supposing that there is no determinate pole to which all needles point, but that every place has its own particular pole and polar revolution, governed, probably, by some one general *but at present unknown cause.* If, then, the magnetic pole of any place should be nearly coincident with the terrestrial pole, the line of no variation, notwithstanding the rotation, must remain nearly stationary; but where the variation is considerable, the change would be very slow while it is passing through its maximum.

J. W. W.

* *Encycl. Metrop. Art. Magnetism.*

ON FLAME AND COMBUSTION—MR. RUTTER IN REPLY TO MR. WITTY.

Dear Sir,—An apology is due from me to yourself, and to Mr. Witty, for noticing, so long after date, some remarks in that gentleman's paper, Mech. Mag., No. 545, vol. xx. p. 269. I consider some of Mr. Witty's observations are not consistent with analogy and direct experiment. As may be expected, I am chiefly concerned with those which have a distinct reference to myself.

Having very recently brought together a somewhat formidable list of experiments as illustrative of the phenomena of flame,* and having also, on the same occasion, expressed my views as to its theory, it seems unnecessary to enter very minutely into Mr. Witty's observations on that subject. Mr. Witty's theory is very ingenious; but, I think, it is wholly unsupported by experiment. To me it is inexplicable how aqueous vapour can be "projected into the interior of the flame" of a candle, at the same time that a current of gaseous and vaporous materials is flowing in an opposite direction. Neither can I understand how the liberated and combining elements "play backward and forward many hundred times in a second." That idea is too refined and too complex for my imagination. Moreover, the theory of combustion, as exhibited in a candle, is perfectly intelligible, without having recourse to any such rapid and mysterious movements as are hinted at by Mr. Witty.

With that part of Mr. Witty's paper, in which there is an allusion to my heating process, I am more immediately concerned on the present occasion. I proceed, therefore, to its examination.

To the inquiry, "Is it possible, then, to burn coal-tar without producing smoke?" (p. 271.) Mr. Witty replies, "Nothing is more easy to a person pos-

* Mech. Mag. No. 564, pp. 140-147.

sessing a slight knowledge of chemistry. Let a long tunnel of fire-brick be constructed leading to a chimney, and let a coal-fire be lighted till the sides of this tunnel become of a white heat. If a small stream of coal-tar be now introduced it will inflame, and as the particles of carbon deposited (disengaged?) cannot lose their heat, and will be floating in a strata of air heated to redness, (?) their union with oxygen must take place, provided sufficient air be admitted with the stream of coal-tar." Mr. Witty has not told us whether it will be necessary to keep up the coal-fire after the sides of the tunnel become of a white heat, and the stream of coal-tar has been introduced. This is very important in determining about the cost of the process, as compared with others for generating heat. Perhaps we may be able, by-and-by, to understand this matter more satisfactorily.

That the chemical union of hydrogen, carbon, and oxygen, in the process of combustion, is attended by the extrication of heat, and that the quantity (or intensity) of heat evolved in the combustion of a given quantity of fuel, depends very much on the quality of that fuel, and the treatment to which it may be subjected, are facts with which every chemist is, or ought to be, familiarly acquainted. Those kinds of fuel in which the elements of inflammability are assimilated in the most suitable proportions, for entering readily into combination with oxygen, yield, from a given weight of the inflammable body, a greater quantity (or intensity) of heat than can be obtained from the same weight of fuel, wherein one of the inflammable elements may be excessive, whilst another may be deficient. We find this indicated in the following experiments of Dr. Dalton, which are not, perhaps, rigidly exact; but they are, undoubtedly, highly important as approximations:—

Substance burnt 1 lb.	Oxygen consumed in lbs.	Ice melted in lbs.	Ratios of heat.
Hydrogen gas	8	320	16·0
Carburetted hydrogen	6	85	4·25
Olefiant gas	4·375	88	4·4
Carbonic oxide	0·4375	25	1·25
Olive oil	3·033	104	5·2
Wax	3·14	104	5·2
Tallow	3·14	104	5·2
Oil of turpentine	3·14	60	3·0
Alcohol	3·477	58	2·9
Sulphuric ether	4·296	62	3·1
Phosphorus	1·333	60	3·0
Charcoal	2·666	40	2·0
Sulphur	1·5	20	1·0
Camphor	3·021	70	3·5
Caoutchouc	5·265	42	2·1

It demands our attention that, next to hydrogen and oxygen, in a gaseous form, the greatest quantity of heat is obtained from olive oil, wax, and tallow, in combination with oxygen; and whilst 1 lb. of hydrogen requires 8 lbs. of oxygen for its complete combustion, 1 lb. of olive oil requires only 3.033 lbs. of oxygen. We may hence conclude that about 3 lbs. of olive oil, and rather more than 9 lbs. of oxygen, will yield the same quantity of heat as the direct union of 1 lb. of hydrogen and 8 lbs. of oxygen, in their gaseous state.

It is further deserving of remark, that *those bodies in which an* excess of carbon *resides, as oil of turpentine*, charcoal, and caoutchouc, give out, in combustion, a much less quantity of heat than some other bodies in which hydrogen and carbon are assimilated in more exact proportions. For example:—1 lb. of olive oil and 3.033 lbs. oxygen produce sufficient heat to melt 104 lbs. of ice, whilst 1 lb. of oil of turpentine and 3.14 lbs. of oxygen will melt only 60 lbs. of ice. It is but fair to conclude that, at least, one third part of the oil of turpentine escaped as lamp-black in an uncombined state. Suppose that, by some specific arrangement, the whole of the 1 lb. of turpentine could be made to combine with oxygen, instead of 3.14 lbs. of the latter element, there would be re-

quired (say) 4.71 lbs. of oxygen; and, instead of 60 lbs. of ice being melted by the turpentine, say that 90 lbs. were melted. Still the weight of materials will be greater, and the ratio of heat less, than with olive oil. The account will stand thus:—

Oil of turpentine,	1 lb.	oxygen, 4.71 lbs.=5.71 lbs.,	ice melted=	90 lbs.
Olive oil,	1 lb.	oxygen, 3.033 lbs.=4.033 lbs.	..	=104 lbs.

Or, if we take oil of turpentine as it stands in the table—and, as the conditions observed in the combustion of the several materials were the same in every case, it is but just that we should do so—the relative quantities will be—

Olive oil and oxygen,	4.033 lbs.,	ice melted,	104 lbs.
Oil of turpentine and oxygen,	4.14 lbs.	..	60 lbs.

Ratio of heat in favour of the olive oil as 5.2 to 3.

Highly interesting and important as are these experiments of Dr. Dalton, they only indicate results from the employment of oxygen. To render them more extensively useful, they require to be repeated with atmospheric air, noting accurately the amount of oxygen abstracted under different circumstances.

That coal-tar possesses quantities very similar to those exhibited by oil of turpentine is, I suppose, undeniable. The phenomena attending its combustion plainly denote a deficiency of hydrogen and an excess of carbon. To employ coal-tar successfully as fuel, it is not difficult to conceive that a greater quantity of that body and of oxygen will be required to produce a given result, than of some other body whose elements combine with oxygen more readily. In practice this is found to be the case. In several gas-works in the kingdom coal-tar is employed as fuel; in some cases in conjunction with solid fuel, in others without its aid. It is, however, when used alone, any thing rather than an economical substitute for solid fuel. In some places it is necessary to burn it solely with a view to be relieved of an intolerable nuisance. In coal-tar there is not a sufficiency of hydrogen to produce, by its own inflammation, that separation and recomposition of elements which is an essential condition to the beneficial employment of every heating agent. The whole of the carbon in coal may be made to combine with oxygen; but, as has been shown by Mr. Witty, this can be effected only by a particular arrangement, and at a very elevated temperature. The more perfect the combination thus brought about, the greater will be *the quantity of oxygen* employed, and consequently the greater the quantity of azote that will require to be heated. The latter condition involves a great expenditure of the inflammable material.

There is a circumstance connected with the experiments recorded in the foregoing table, that ought not to be passed over in silence. I do not remember to have seen any direct allusion to the principle that is here very distinctly recognised. I refer to the heat that is evidently the result of chemical action. Take, as an example, olefiant gas, in which we may have imagined that, by previous preparation, the elements of which that gas is composed, would be arranged in a way highly favourable to their union with oxygen, and the consequent extrication of heat. We find, however, that 1 lb. of olefiant gas requires for its combustion 4.375 lbs. of oxygen, by which it is enabled to melt 85 lbs. of ice, whilst 1 lb. of olive oil requires only 3.033 lbs. of oxygen, and yields heat sufficient to melt 104 lbs. of ice.* May we not hence learn that vaporisation, when immediately and simultaneously attended by inflammation, decomposition, and recombinations of the vaporised materials, is not a *cooling* but a *heating* process?

Mr. Witty, page 271, says, in reference to my "project of introducing a small quantity of water with the tar, that two intense chemical actions are supported with (by) the same volume of air that either of them would require separately;" and further, that "your Salisbury correspondent has certainly blundered in endeavouring to explain this." The passage alluded to is an extract

* The difference in the combustion of olefiant gas and of olive oil may be understood by a reference to No. 564, page 146, § 47.

from my prospectus. It may be rather obscure, but there is no attempt, or, at any rate, no intention of explaining "two intense chemical actions as being supported by the same volume of air that either of them would require separately." May I be permitted to make the passage more intelligible by paraphrasing it a little? "In the process here described, oxygen, instead of being admitted in any great quantity from *without* [as is necessary in effecting the entire combination of the elements of coal under ordinary circumstances, and of coal-tar when used as fuel alone], is generated *within* the furnace [by the decomposition of aqueous vapours in conjunction with coal-tar]; and, instead of its [*i. e.* the oxygen so generated within the furnace] being accompanied by azote, which retards combustion and extinguishes flame, it is accompanied by hydrogen, one of the most inflammable of the gases."

The practical utility of this process has been very fully demonstrated. It will commend itself to all who will take the trouble to make themselves acquainted with its conditions, and especially those who are interested in gas operations. The gas-work was its "birth-place," and for the present may be considered its "home." With a properly constructed furnace it may, however, be rendered equally applicable to steam-boilers as to any other purpose in which intense heat is required in an enclosed fire-place.

The theory of the process appears to me exceedingly simple. It may be thus explained:—Coal-tar abounds in carbon, but is deficient in hydrogen; water is readily decomposed in conjunction with the elements of coal-tar in a state of inflammability, yielding hydrogen 2 volumes, oxygen 1 volume. Hydrogen unites with certain definite proportions of carbon, and constitutes olefiant and carburetted hydrogen gases, which gases, by the accession of oxygen from the atmosphere, are decomposed, their elements combining with distinct portions of oxygen, and yielding (oxygen 1 vol., hydrogen 2 vols.) aqueous vapour and (oxygen 1 vol., carbon 1 vol.) carbonic acid. The oxygen liberated in the decomposition of water, in this process, does not perform the office of a supporter, but, uniting with carbon (carbon 1 vol., oxygen ½ vol.), *forms carbonic oxide.* Carbonic oxide, at the temperature of inflammability, readily combines with an additional ½ vol. of oxygen (carbon 1 vol., oxygen 1 vol.), and becomes carbonic acid.

The heat liberated in the process thus briefly described, is not entirely due to the qualities of the respective materials. A part may justly be attributed to a series of chemical agencies and affinities, called into exercise under circumstances the most favourable to the separation and recomposition of dissimilar elements.

What is there at variance with analogy, or with our experience, in the decomposition of water (aqueous vapour) when in intimate union with carbon? Aqueous vapour is a constituent of alcohol and of ether; and judging from the habits of each of these bodies, we may infer that carbon is more inflammable when combined with aqueous vapour than under any other circumstances. The theory of the combustion of coal-tar and water, can scarcely be said to differ from that of alcohol, or of ether. I believe its most appropriate parallel is to be found in the latter. The preparatory conditions are, of course, essentially different.

To decompose water in contact with an oxidisable surface, in close vessels, is a tedious and a comparatively difficult process. The elective affinities of the elements of bodies, and especially of those now under consideration, are dependent, very materially, on particular circumstances. We know, from every-day experience, how these affinities are affected by change of form and of temperature. At every step we take in experimental science, we find facts illustrative of this important principle crowding around us.

In practical operations it may not be possible to make out the relative proportions of coal-tar, or other similar materials, and of water, with mathematical accuracy, so that every atom of hydrogen, oxygen, and carbon, shall be separated and recombined; but that the greater part of the respective elements do undergo these changes, is attested by the quantity (or intensity) of heat generated from a comparatively small quantity of the inflammable materials, and by other circumstances which it is unnecessary here fully to explain.

Mr. Witty mentions "a strata of air

heated to redness." Will he be so good as to inform your readers if he has ever witnessed that phenomenon? The late Mr. Wedgwood instituted some very interesting experiments on this subject. He heated air until it readily imparted incandescence to metallic bodies with which it was in contact; but every endeavour to render air itself incandescent, or in the slightest degree luminous, was unavailing. A very simple experiment will show that air is not luminous at a temperature equal to that of redness, in metallic or solid carbonaceous bodies. If a lighted taper be held underneath a burner, through which coal-gas is passing, the gas will be inflamed by the current of heated air that ascends from the taper, and without being in actual contact with the flame. The same experiment may be performed by projecting a stream of coal-gas across the column of heated air ascending from a gas-burner, when the gas will be inflamed. In the same way may a taper or a candle be inflamed, at a distance of several inches from a gas-flame. As it is generally admitted that coal-gas cannot be inflamed by contact with a solid body below redness, we may infer that the column of air ascending from a taper, although not luminous, possesses a specific temperature, equal to, and perhaps very far exceeding, that radiated from solid bodies, when heated to redness. The two cases appear to me precisely parallel, since it is impossible to bring a gaseous body in actual contact with a red-hot solid. Inflammation and decomposition of gaseous bodies is dependent, therefore, among other circumstances, on specific temperature; and it matters not whether the inflammable body be in the immediate vicinity (for we cannot imagine it to be in actual contact) of a luminous body, or at a distance from it, so that a certain temperature is preserved.

Mr. Witty says, "perhaps two gallons of water is more than one gallon of coal-tar could be made to decompose." I usually employ the materials in the proportions of 1 volume of tar to 1½ volume of water. I have, however, passed 3 volumes of water into the furnace with 1 volume of tar, and with the most satisfactory results. This can only be done when *the stratum of coke* on the furnace-bars is in a highly ignited state, and when the area of the furnace throughout approaches to whiteness. A careful analysis of coal-tar is necessary to enable us to understand all the conditions that stand connected with the theory of this process. I have never yet met with any information on the subject that could be depended on. It would occupy too much time and space to go into my own experiments and observations on the present occasion. I may just remark, however, that a much greater quantity of water may be beneficially employed, in conjunction with coal-tar, than may generally be inferred from our ordinary conceptions of the respective materials. By *beneficial* employment I mean, of course, that mode of operation, in which successive increments of heat are satisfactorily denoted by an increase of the relative proportions of water, as compared with those of tar.

Speaking of steam-boilers, Mr. Witty says, "according to my experience the sides of boilers are often many hundred degrees hotter than the contained water, and sometimes red-hot just at the outer surface." Is Mr. Witty quite sure that he has *seen* what he here describes?

Dear sir,
I am your faithful servant,
J. O. N. RUTTER.

Lymington, June 14, 1834.

THE "GERVAIS FERMENTING APPARATUS IMPROVED."

(See Mech. Mag. vol. xxi. pp. 129-133.)

Sir,—When Messrs. Deurbrouck and Nichols first communicated their method to the public, I endeavoured to convince myself, by experiment on a small scale, whether or not the results were to be realised which they stated as attainable. I had a circular hole cut in the head of a hogshead, fit to receive an alembic head, such as is frequently used with small stills for the distillation of herbs, &c. The hogshead stood on its bottom. Thirty-six gallons of wort, with the necessary quantity of yeast to carry on the fermentation, were put into it. The alembic head was applied to the aperture and luted down, and the cask rendered air-tight. Cold water was put into the alembic head (as shown in your sketch, No. 564), and to the end of the

pipe (which projected over the side of the cask externally, and not entering into it as in the tun, as you have described it), which usually conveys the alcoholic vapours from the still in a condensed state into a receiver. When used for distillation I attached a glass receiver. The result was that much carbonic acid gas came over into the receiver, which, as the receiver was not closed, escaped into the atmosphere. A small quantity of condensed fluid also flowed into the receiver, which I both tasted and tested by the hydrometer, but could not discover a particle of spirit among it, and I found that its specific gravity was but little greater than spring water.

Such a practical result was sufficient to convince me that no advantages were to be derived from the adoption of the method, either as relates to preservation of spirit, or volume of the wort; and as relates to the quality of beer so fermented, the experiment was tried on too small a scale to exhibit any satisfactory proofs.

I could furnish many theoretical reasons to prove that the adoption of the system would prove injurious to any brewer of beer, and most probably the wine maker and distiller, as well as the vinegar maker, but I have neither time nor inclination.

One or two observations alone may suffice to convince. All the operations of what is called nature are perfect. In vinous fermentation the production of spirit is a natural process, and the wise Author of the process has secured the preservation of the product during the production. In vinous fermentation the formation of carbonic acid gas is a necessary consequence, and its disengagement and liberation from the wort is indispensable to the due fulfilment of the process, and the creation of spirit. The extrication of such gas causes a diminution of the volume of the wort, and to complete the process the loss must be submitted to. As the production and liberation of carbonic acid gas is a means to an end, any attempt to frustrate the means must be also calculated to frustrate the end.

I am, sir, yours, &c.

G. A.

DESCRIPTION OF A VACUUM-MAKER. INVENTED BY J. UDNY, M.D.

Sir,—Having done me the honour to mention my steam-engine, I take the liberty to send you a description of a vacuum-maker, which has been favourably spoken of by competent judges. I shall be obliged by your giving it a place in your work, and am

Your most obedient,

J. UDNY.

Description.

The apparatus consists of a wheel (which may be the fly), having a hollow axle, with hollow spokes or radii, opening on the circumference. The open end of the axle fits into an air-tight vessel, connected with the cylinder of the engine. In the prefixed figure, *a* represents the hollow axle, *b* the spokes or radii, *c* the openings of ditto, *d* the plates on the circumference of the wheel. The arrows show the direction of the steam. When this wheel is put into rapid motion, every thing in the spokes will, of course, be thrown out by centrifugal force, and every thing will rush from the cylinder, through the axle, to the spokes, and be continually ejected. To increase this effect, the plates are placed on the margin of the wheel, *in front of each opening of the spokes.* By them the air is displaced, and a vacuum formed all round the wheel, and (after the first effort) without reference to the engine. For if the plates be 7 feet asunder, and the wheel rotates 200 times in the minute,

each plate will pass through that space in one-sixth of a second, and the atmosphere will not have time to rush in. The wheel must be in a case, communicating by a pipe *with the air*.

In a steam-vessel, *an injection-pipe may enter the chamber, into which the hollow axle is inserted* (the axle being at the bottom of the chamber), and condensation will be produced, while the gravity of the fluid will cause the centrifugal force to be more effective. The wheel being placed above the water-line, the water will run out of the wheel-case by its own gravity. Or the injection-pipe may pass into the outer case, and the water be made to fall on the margin of the wheel, and cause condensation.

ON THE HARDNESS OF IRON CASTINGS. BY MR. RUFUS TYLER, MECHANIST, PHILADELPHIA.

(From the Franklin Journal.)

Formerly, mechanists experienced much difficulty in procuring iron castings of sufficient softness to admit of being worked with any facility, and even at the present day the art of producing castings, of any desired quality, is involved in some degree of obscurity. I shall endeavour, in my communication, to remove this obscurity, and thus to enable the founder to economise metal, and to assist mechanists in determining, with readiness and accuracy, the fitness of any casting which may be offered to them.

It is usual to distinguish the hardest and softest kinds of cast iron, by the terms white and black, and all intermediate degrees by the term grey. The darker shades indicate the greater proportions of carbon which the material contains, and are most highly valued for melting, as a portion of this substance is unavoidably lost in that operation.

These indications, so far as the different shades of grey actually appear, may generally be relied upon for determining the quality of any article under examination; but circumstances incident to the casting, may cause each and all of them to assume the appearance and properties of the white variety, from which they cannot afterwards be distinguished, except by annealing, by re-melting, or by chemical analysis. It is a mistake, therefore, to attribute to a deficiency of carbon, as is almost universally done, properties common to castings of every degree of carbonization; properties which will be found upon investigation, to *depend upon the particular arrangement of the particles*, assumed in passing from the fluid to the solid state, *determined by the length of time occupied in cooling, and by the proportion of carbon conjointly.*

It is a fact, with which every workman in this material is familiarly acquainted, that opposite qualities are frequently exhibited in different parts of the same piece of casting. This is generally supposed to arise from an unequal distribution of the carbon, caused by the more rapid cooling of the thinner parts, which are always the first to assume the crystalline form. Hence it is the universal practice among founders, in making selections for melting, to break off and reject the hard parts, and to retain those which are soft for producing soft castings, and *vice versa*, for hard. In reality, every piece of cast iron, appearances to the contrary notwithstanding, is of the same composition throughout; and, further, it is only from such pieces as present both the hard and soft form, that an accurate knowledge can be obtained of the qualities of the material by inspection.

A knowledge of this fact is of the utmost importance to founders since, under their present mistaken views, they are liable not only to undervalue much of their best material, because of its close resemblance to that which is inferior, but whenever this same supposed hard metal is employed for casting articles in which extreme hardness is a principal requisite, a disappointment necessarily results, except in castings which happen to be as thin as those from which the selection for the furnace has been made. As it frequently happens that a charge is made up of both *real* and *supposed* hard iron, the result is seldom so totally at variance with what is expected, as in the case which I have just supposed. It is, however, in general sufficiently so to call forth the usual explanation, namely, that the metal has been improved, that is, has received an accession of carbon, in the furnace, although the reverse is known to take place generally, and to such an extent, that after metal of the softest quality has been re-melted half a dozen times, it is no longer fit for any but the hardest castings; indeed, an allowance for this must always be made, particularly in the common air-furnace, which hardens metal more than the cupola or blast furnace.

In attempting to produce extreme hardness, in thick masses, there is a difficulty in addition to that of the improper selection of metal. The high-melting point of the metal, suitable for such purposes, produces this difficulty, which is further increased by the necessity of choosing from masses, as large, at least, as those which it is intended to produce. This, however, will not be re-

garded as an inconvenience, by those who are not aware that *hard* metal, in the form of thin scraps, may, or may not, produce hard castings, of larger, or rather of thicker, masses, at least by those who not having very powerful furnaces, reject large masses altogether. It is probably owing to this circumstance, together with the want of correct theory, that recourse is generally had to the artificial "chill," for hardening anvil-faces, and many similar articles, thereby causing the metal to consolidate within the *hardening limit of time.*

By the employment of metal found to be truly hard, in pieces as large as can be conveniently managed, there will be no need of chilling any castings, smaller than those from which such selections have been made.

Some years ago, a notice went the rounds of the journals, of the discovery that hard cast iron might be rendered quite soft by annealing in sugar.

I have before stated, that castings having different proportions of carbon, but resembling each other in being very hard, may be distinguished from each other by annealing; the fact is, that iron, highly carbonized, but hard from being chilled, or from being cast in very thin plates, may be softened by a simple annealing, and this may account for its working so *sweetly,* as your worthy editor would say, after sugaring, as I did not find that experiment to succeed in a trial to which I subjected a piece of my own selecting.

Those who suppose that there is an unequal distribution of the carbon, in pieces which are soft and hard in spots, are answered by asking, what becomes of the carbon when a piece which would otherwise be grey and soft, is chilled in such a manner as to be rendered white and hard throughout, under circumstances which do not well admit the supposition, that the carbon has escaped? For instance, let a hole, half an inch in diameter, be drilled six or more inches deep, in a large block of brass, we must avoid cast iron, for that might be said to absorb the carbon, and filled with melted iron. Now no one can doubt, that, in this case, the casting would be hardened through. It is necessary, therefore, to seek for some other theory than the one just mentioned, to account for this phenomenon. The one which I have adopted, as before stated, supposes, that whenever such a result takes place, it is due to circumstances in the *time of cooling;* in other words, that every piece of casting, whether white or grey, being remelted without changing the proportions of carbon and iron, will reproduce the same quality, if the time occupied in congealing *be the same as before.*

According to this theory, every different quality of cast iron has *its own rate of cooling,* which determines the character it will assume. To illustrate this point, after I had long known the fact, I had a pattern made, consisting of two wedges, as nearly alike as possible; being about two inches wide, by three in length, and tapering from half an inch thick at the back to as thin an edge as could be well cast in the usual moulds of sand.

These wedges were then connected at their backs by a piece as wide as one of the wedges, and about half an inch in thickness, in such a manner as to insure equality in moulding and casting in all respects: the edges being downward in the mould, caused them to fill by pressure, very perfectly. From this pattern, or double wedge, I procured castings of various qualities of metal, from very soft, and highly carbonized, to that which was of medium quality (degree of carbonisation), and when broken diagonally across, one of the wedges of each pair from the edge towards the back, exhibited in the same fracture both the white and grey iron. In each the white always commenced at the edge, and extended towards the back, where it met the grey, the transition being sudden, and tolerably well-defined, but varying in *distance* from the edge, with the *shade* of grey, and thus furnishing a relative scale of measurement of the different qualities of the material.

This line of transition was found to follow very accurately the line of equal thickness, or which is the same thing, of equal distance from the edge, across the wedge from side to side. The same appearance was exhibited by the other wedge of the pair, as was anticipated; and any number of similar wedges, cast under the same circumstances, of the same metal, whether connected or not, would exactly coincide, the time of cooling being the same in each.

From these facts, it is manifest that nothing more is necessary to enable one to determine the precise hardness of any casting, without defacing it, than to search out some thin wedge shaped part which may be broken off without injury; a wedge may be previously attached to the pattern, for the purpose, from any one of the castings made at the same time, of the same metal; and by noting the thickness at which the white form passes into grey, having previous knowledge of the quality due to that thickness.

An exception to this rule will be found in the last running of a heat, which is always harder than the first, the reason of which is, that the metal goes into the mould at a temperature considerably lower than at first,

sequently does not heat it to the same , and therefore the time of cooling of tal will be less for a given thickness. equently to the experiment before ned, I procured some pieces of differ- ds of iron, cast from a pattern in the f a cup, the rim of which was wedge- , instead of the double wedge, as being m an objection which ought to have mentioned in its proper place, to wit, e edges being more exposed than the of the wedge, would cool sooner, and iently remove the hardening point a rther up, making a slight variation line of transition, at those points.

probable, likewise, that these results be slightly modified by another prin- which was indicated by the cast wedge ; such forms as terminate every where es thicker than the hardening point, portions are just inferior in thickness t point, no hardening would take as the hard form, which is probably ult of crystallisation, seems in this, as r substances, to require some arrange- y which it may be commenced, and which it will extend. Indeed, I have to believe, that where, from the nature furnace, or the metal employed, or he acuteness of the angles in the pieces cast, danger is apprehended that the most exposed will become hard for a distance, this result may be prevented y, by removing from the pattern these to *a less distance*. Such small por- may well be spared, even if recourse afterwards be had to the file, or chisel, toring to the casting its proper form. he examination of a lot of castings at undry, care should be taken to avoid ng such pieces, or parts, for breaking, likely to have had the rate of cooling d by peculiar circumstances, such as *tes* (parts of which are either exposed atmosphere, or to sand immediately l by the metal running over it), or parts immediately in contact with large s, which would cause them to remain in a fluid state. In this there is sel- ny difficulty, as there are generally to nd, for some days after any particular gs have been made, imperfect or da- l pieces, known to have been cast at the time, upon which the examination can de. Although wedge-formed pieces, for s which now must be sufficiently ob- are to be preferred, yet is often suffi- to examine the fracture of a piece of hape, provided its time of cooling be within that allowed to the thinnest n of those to be determined; for the on, generally, is not, what is the pre- uality, *but whether castings are soft to admit of being worked.*

DRAWING ISOMETRICAL PERSPECTIVE ON WOOD.

Sir,—I felt much gratified by the perusal of R.'s communication of last week, on "Isometrical Perspective."

R.'s hints are very important, and I would venture to suggest, that in addition to the "altering bevil," which he recommends, that one fixed at an angle of 60° should be used. The "isometrical triangle," or "set," may readily be converted into the latter instrument, by introducing either of its edges, as may be most convenient, into a grooved stock. This, whilst it may be made easily moveable, may be fixed perfectly firm to the triangle by a small screw. With this instrument the most important parallel lines, in six different directions, may, without the trouble of adjustment, be drawn at the correct angles. The "altering bevil," which would not be used so frequently, may be set to the angle of any other lines that may be required.

I know of no better or easier way of obtaining a thorough knowledge of radial perspective, or any other projection whatever, than by means of isometrical.

I am, sir, yours, &c.

JOSEPH JOPLING.

FISHERMAN'S LAMP.

Sir,—I beg to inform your correspondent, H. P., that the plan I have suggested for a fisherman's submarine lamp is still theory, so far as I am concerned. I found it entered in my common-place book with the date 24th May, 1830, and proposed it to your readers, in order that it might be tried should it seem worth the while. My plan for using it was somewhat different from H. P.'s. I proposed to enclose the lamp in a chamber constructed with a frame of wood, and walled on all sides with that kind of net called trammel net. This seemed to me the best plan, when comparatively few fish are sought for at once; but in herring fishing, I should propose to let the light float free, and to shoot the nets at a proper distance around it, so that the light may be drawn in along with the fish.

Such a lamp might also afford much amusement and instruction to the zoologist. At night he might lean over the edge of his boat, and be an unsuspected witness of the speculations and gambols

of the fishes about the lamp; and it is not improbable that information respecting the peculiar habits of the gazing assembly below him might be gained in that way, which could not be had by any other. I am, sir, &c.,

φ. μ.

GAUZE RIBBONS.

Sir,—The very beautiful gauze ribbons, of every variety of hue and of pattern, that are now so generally worn by our fair countrywomen, are deficient in one important quality, namely, *stiffness*. These ribbons, a great proportion of which, I am grieved to say, are of foreign manufacture, when made up, for the purpose of adorning caps and bonnets, require to be supported by attaching to the wrong side what is called in the trade *wire-ribbon*.

Without pretending to possess any practical knowledge of the manufacture of ribbons, I may, perhaps, be allowed to suggest, that if two or three, or more (according to width), very fine wires were worked, at equal distances, into the warp of the ribbons, their durability would be greatly increased, and their appearance very materially improved.

The manufacturers may, probably, think it more to their interest to continue to make articles that soon spoil. Is there not a limit to the advantages consequent on such selfish views as these?

Δ.

June 10.

INSTANCES OF GALVANIC ACTION.

Sir,—It is a common practice with coppersmiths to use iron wire in the turn-over edges of copper funnels, measures, and other similar utensils. Whenever moisture finds access to this wire a galvanic action ensues; and that part of the vessel which ought to be the strongest soon proves to be the weakest, by the oxidation of the wire and of the copper in its vicinity. When a wire is requisite for stiffening the edges of copper vessels, that made of the same kind of metal should be employed, even at a trifling sacrifice of good taste, as respects appearances. A copper wire must be larger than one of iron, if the same degree of resistance is required.

For tin vessels, the surface of the iron wire employed in turn-over edges should be well tinned. A similar action will otherwise ensue, as has bee noticed.

In fixing lead pipes, for water or other liquids, iron holdfasts are usually emploj galvanic action in this case so energetic as in those just e1 It is, notwithstanding, desira vent immediate contact of th tals, by interposing a non-c substance, as wood, for insta using supports made of that as often as may be consis security.

The tin-tubing so extensi ployed in gas-fitting, shoulc ported by hooks whose surf been well covered with the san metal.

Low wages and low prices h a system of manufacturing tended only for *sale*, and no Where this system prevails, it less task to endeavour to brin sults of scientific research to l the arts of life. In the grea of cases, we have reason to bel more enlightened views a honourable principles are in To such, we trust, these and sin may be acceptable.

June 10.

ABSTRACTS OF THE PHILOSO TRANSACTIONS.

Actuated, we suppose, by tl tion, that, if "a great book is evil," thirty great books must l too great to be borne, the Roya have wisely determined on th ment of printing a synopsis "Transactions" since the co ment of the present century,* in venient form of two portable a compliance with the "spiri age," for which few would h willing to give that learned boc before the deed was actually c may certainly be taken as an i that its members begin to feel t labours stand a little in need more popularised than they ha hitherto been—that the public

* Abstracts of the Papers printed in sophical Transactions of the Royal Soci don, from 1800 to 1830 inclusive. P order of the President and Council, Journal Book of the Society. London Taylor. 2 vols. 8vo. pp. 516, 448.

take some interest in the pro- of the chief scientific body of on. So far so good: it is by no n unpleasing spectacle to see so l unbending a Society losing, y choice or on compulsion, a tion of its haughty spirit of ex- ess, and condescending to throw sures of its research into "the stock."

y well be conceived what a wil- of information must be pre- by the compression of no less irty ponderous quartos *de omni- us et quibusdam aliis*, into only mes of half the size; especially t is considered that the papers jected to no new arrangement, given precisely in the order in hey happened to be read at the s of the Society. This is a fault, no means a trifling one. It naturally have been expected, s the synopsis extends over a f thirty years, advantage would en taken of the opportunity to he mass to some degree of order, nging the papers relating to each ent of science under a dis- d separate head. This would eatly facilitated the labour of e, not only to the "Abstracts," the "Transactions" at large; he inquirer in any particular of philosophical research would d the whole body of essays on nch under his eye at once, and d the trouble of hunting back- nd forwards through the whole nd often, perhaps, without suc- Unfortunately, however, this op- y has not been embraced; the angement made is that pointed hance, and the only facility for e afforded, that given by the two , which, to say the truth, are ex- copious and useful.

e style in which the "Abstracts" wn up, we shall proceed at once a specimen. It is a paper on a ce which has excited much at- of late years, in what may be the *practically-scientific* circles, ich is supposed by some to be the l from which the sabres of Da- are fabricated, and to which they ebted for their almost miraculous *properties.* The original paper, *s of considerable length,* ap- peared in the "Philosophical Transactions" for 1805:—

"The fine cakes of the kind of steel called Wootz, which form the subject of the present paper, were delivered to Mr. Mushet, for the purpose of examination, by Sir Joseph Banks. Mr. Mushet begins his account of them by giving a very minute description of the form, the grain, and every other external character of these cakes. This description cannot well be abridged, and is too long to be repeated. We shall, therefore, only say, that *Mr. Mushet states,* as a general remark, that the grain and density of these cakes of wootz were uniformly homogeneous, and free from metallic iron towards the under or round surface; but that they were always the reverse towards the upper side, *called by Mr. Mushet* the feeder.

"The appearances observed upon forging these cakes are then particularly described, from which *Mr. Mushet deduces* the following general remarks:—

"The formation of wootz, he says, appears to him to be in consequence of the fusion of a particular ore, which *he supposes* to be calcareous, or to be rendered so by a mixture of calcareous earth, along with a portion of carbonaceous matter. The fusion, *he thinks,* is performed in a clay vessel, or crucible, in which vessel the separated metal is allowed to cool. Hence, *in his opinion,* arises the crystallisation that occupies the pits and cells observed in and upon the under or round surface of the cakes.

"The want of homogeneity and solidity in these cakes, *appears to Mr. Mushet,* to be owing to the want of a sufficient degree of heat to effect a perfect reduction; and this opinion, *he thinks,* is strengthened by observing, that those cakes which are the hardest, or which contain the largest portion of carbonaceous matter, are always the most solid and homogeneous; while, on the contrary, those cakes which are the most easily cut by the chisel, are, in general, cellular, and abound with veins of malleable iron. If the natives of the country which produces the wootz were capable of rendering it perfectly fluid, *Mr. Mushet thinks* they would certainly have run it into moulds, by which, *he says,* they would have acquired a kind of steel more uniform in its quality, and more fit for the purpose of being worked and applied to the arts.

"Some of the cakes here described had around the feeder, and upon the upper surface in general, evident marks of the hammer. This appearance *Mr. Mushet accounts for* by supposing, that when the cake was taken from the pot or crucible, the feeder was most probably slightly elevated, and the top of the cake covered in part with small

masses of ore, which, from want of a sufficient degree of heat, had not been perfectly fused. These, *he thinks*, are cut off at a second heating, and the surface then hammered smooth, to make the cakes more fit for sale. *Mr. Mushet says* he has observed similar appearances in operations of a like nature, where the heat has been insufficient; and that such phenomena sometimes take place in separating crude iron from its ores, when, from its containing an excess of carbon it is difficult to be fused.

"The division of the cakes, by the native manufacturer, *he thinks*, is done merely to facilitate its subsequent application to the purposes of the artist, and to serve as a test of the quality of the steel.

"In order to determine, by direct experiment, whether wootz owes its hardness to an excess of carbon, Mr. Mushet made some comparative experiments upon the cakes, and upon common cast steel and white cast-iron. In operations of this kind, *he says*, he has always found the proportion of carbon best ascertained by the quantity of lead reduced from flint-glass. He, therefore, mixed a certain quantity of wootz, or of steel, or iron, with three times the weight of pounded flint-glass, and exposed the mixture to a heat of 160° of Wedgwood's pyrometer.

"The result of these experiments was as follows:—

"The wootz of the 1st cake reduced its own weight of lead.	0·139
"That of the . . 2d	0·125
3d	0·120
4th	0·155
5th	0·102
"Steel, containing $\frac{1}{80}$ its weight of carbon	0·094
"White cast-iron	0·228

"From these experiments, *the author says*, it appears, that wootz contains a greater proportion of carbonaceous matter than the common sorts of cast-steel, and that some particular cakes approach very near to the nature of cast-iron. This, added to the imperfect reduction, *seems to him* quite sufficient to account for its refractory nature, and for the want of homogeneity in its texture.

"Notwithstanding the above imperfections, *Mr. Mushet thinks* wootz possesses the radical principles of good steel, and that it is impossible not to have a very high opinion of the excellence of the ore from which it is produced; the possession of which, for the fabrication of steel and bar-iron, would be an object of the highest importance. It is, *he says*, a subject of regret *that such a source of* wealth cannot be an*nexed to the dominions of* this country; as, *in that case,* the East India Company might supply their settlements with an article superior in quality, and inferior in price, to any they send from this country."—Vol. I. p. 183.

We have taken the liberty to print a word or two here and there of this extract in italics, by way of pointing out the praiseworthy caution of the Society. Not content with prefacing every volume of their Transactions with a very formal declaration that they will not hold themselves responsible for any of the opinions advanced—in fact, that they do not, collectively, hold any opinion at all; it will be seen that, in these Abstracts, abridged as the papers are, they take care to "put the saddle on the right horse" at every turn. The reader cannot complain that he is taken in by the apparent sanction of the Society, when he is so often told that the facts are only those which "Mr. Mushet states"—the inferences, only those which "Mr. Mushet deduces." and the whole only what "*he* says," and "*he* thinks." Seriously speaking, there is a great deal too much of this; it would surely have been enough to have entered the usual general caveat at the beginning, and have avoided disfiguring each paper, occupying valuable space, and trifling with the reader's attention, by repeating the same thing in almost the same shape some thousands of times over.

The excuse for these and similar defects is, that the Abstracts are printed exactly as they were entered, at the time of the papers being read, in "the journal books of the Society," without garbling or alteration;* but we fear this plea is not altogether well founded. It is pretty well known that the opinions of Sir Humphry Davy on the nature of flame have, notwithstanding his high reputation, met with considerable opposition, and been generally considered as untenable, in whatever light they may have been looked upon when they were first promulgated. It seems, indeed, that there must have been some suspicions as to their correctness entertained when the analysis of

* We suppose not the *slightest* alteration was permitted, or such sentences as the following would have been corrected ere they appeared in public:—"The author however, says, Mr. Knight is not particularly happy in the manner of developing the kind of functions treated of in his Preface, and therefore in the present note (Mr. Knight) gives a solution of a class of equations of which Mr. Spence has considered a particular case, without however resolving (it)."

Sir Humphry's paper was entered "on the journal books of the Society," for there certainly appears to be some difference between the original and the abstract, as the following parallel passages will testify:—

"These results are best explained by considering the nature of the flame of combustible bodies, which, in all cases, must be considered as the combustion of an *explosive mixture* of inflammable gas, or vapour and air; for it *cannot* be regarded, as a *mere combustion at the surface of* contact of the inflammable matter; and the fact is proved by holding a taper, or a piece of burning phosphorus, within a large flame made by the combustion of alcohol—the flame of the candle or of the phosphorus will appear in the centre of the other flame, proving that there is oxygen even in its interior part."—Phil. Trans., 1816, p. 116.

"With a view to explain the non-transmission of heat through small apertures, the author considers the nature of flame in general; and since a piece of phosphorus, or even a small taper, will burn in the midst of a large flame made by the combustion of alcohol, he is of opinion that oxygen exists in the centre of all flame, forming an explosive mixture with the vapour, but which *burns solely at the exterior surface, because it is there alone sufficiently heated to take fire.*"—Abstracts, vol. ii. p. 36.

It is assuredly rather strange, that the *abstractor* should have found words (we allude especially to the concluding ones of our quotation) *at the time*, which are not *now* to be found in the essay he professes to abridge, and which, moreover, throw rather a *new light* on the subject. There are also some omissions in the analysis of the same paper, which are not easily accounted for, and tend to shake that confidence in the complete fidelity of the "Abstracts," which is so essential to the existence of their reputation as "honest chronicles." This should, of course, have been avoided; for, once let the notion become current, that the Abstracts are not strictly faithful copies in miniature of their originals, and the utility of the work is at an end. This would be a pity, since the reduced "Transactions" must be a valuable acquisition in many places, where the voluminous work in full is not accessible.

It is rather singular that most scientific miscellanies published in England, where the application of science to the useful arts, and the ordinary purposes of life, is carried to a far greater extent than in any other country on the face of the globe, are remarkably deficient in information of a corresponding practical nature. The observation will apply in all its force to these volumes, in which a much larger space is afforded to papers on such subjects as "the formation of fat in the intestine of the tadpole," than on the progress of the great conqueror Steam. There is an exception to the rule, however, in the shape of an interesting paper on the improvements successively effected in the Cornish steam-engines, by the late President, Mr. Davies Gilbert, which is well worth transferring to our pages:—

"The terms proposed by Mr. Watt, in virtue of his patent in 1769, which secured to him, until the year 1800, the receipts of one-third of all the savings in fuel resulting from the adoption of his improvements in the construction of the engine, rendered it necessary to institute an accurate comparison between the efficiency of his with former engines. A copy of the report drawn up on this occasion, in October, 1778, is given in the paper; but as the dynamic unit of one pound avoirdupois, raised through a height of one foot, had not yet been established as the measure of efficiency, the author, proceeding upon the data furnished by that report, calculates that the duty performed by Watt's engine, with the consumption of one bushel of coal, on that occasion, was 7,037,800. In the year 1793, an account was taken of the work performed by seventeen engines, on Mr. Watt's construction, then working in Cornwall,—their average duty was 19,569,000, which exceeds the performance of the former atmospheric engines, in the standard experiments, in the proportion of 2.78 to 1. Some years afterwards, disputes having arisen as to the real performance of Mr. Watt's engines, the matter was referred to five arbiters, of whom the author was one; and their report, dated in May, 1798, is given as far as relates to the duties of the engines. The general average of twenty-three engines was 17,671,000. Since that period, so great have been the improvements in the economy of fuel, and other parts of the machinery, that, in Dec., 1829, the duty of the best engine, with a cylinder of 80 inches, was 25.628,000, exceeding the duty performed in 1795, in the proportion of 3.865 to 1; and that of the atmospheric engine of 1778, in the proportion of 10.75 to 1."—Vol. ii. p. 393.

NOTES AND NOTICES.

The apparent paucity in the numbers of the swallow tribe, which usually make their appearance about this time, has led many persons to remark that these our elegant, and it may be added, useful annual visitants, must have encountered, as a body, some mishap in their migrations, as the season with us has not been unfavourable to their early, nor, from any obvious cause, to their plentiful appearance.—*Sheffield Mercury*.

The *Poor Man's Music*, as it has been happily termed by some one, is no where so much regarded and protected as in the Duchy of Nassau, where it is contrary to law to take bird's-nests: even those of birds of prey cannot be taken without permission from the keeper of the forests. For taking a nest of common singing birds the fine is 5 florins; if nightingales, 15 florins; if the nest be taken out of a garden or pleasure ground, the fine is doubled.

What Dr. Johnson says of second-hand writers, may be applied with equal truth to second-hand inventors. "If I am ever found," he says, in his Preface to Shakspeare's Plays, "to encroach upon the remarks of any other commentator, I am willing that the honour, be it more or less, should be tranferred to the first claimant, for his right, and his alone, stands above dispute; the *second* can prove his pretensions only to himself—nor can himself always distinguish invention with sufficient certainty from recollection."

A correspondent, who is connected with the brewing business, requests us to state, that if the "Subscriber" (No. 561, p. 96), "whose occupation as a brewer requires his getting up at all hours of the night, is desirous of a more simple and efficacious awakener than his alarum, and is disposed to pay moderately for much valuable advice, he will not only put him in possession of such as will enable him to pursue his avocation on much better principles than he is now doing, without ever having occasion to rise in the night, or earlier than six or seven o'clock in the morning, and finish early in the evening, but furnish him with much information beside, which the nature of his inquiries shows that he is not possessed of."—The writer's address may be obtained on application to the Editor.—We have received from another correspondent (Mr. Wm. Pearson, of Bishop Auckland) a description of an alarum, constructed by a clock and watch-maker of that place, which he (Mr. Pearson) has seen in successful operation, and praises for its extraordinary powers. We shall give it in an early Number.

The "Construction for the Trisecting of an Angle or Arc," sent us by a "Professor of Mathematics," and author of an edition of Euclid on a new plan, does *not* trisect the arc exactly—it is but an approximation, which could be of no earthly use.

A petition from Mr. S. R. Bakewell, of Manchester (the inventor of the very ingenious brick-making machine, noticed in Mech. Mag. of May 14, 1831), has been presented to the House of Commons, in which he states, that he "has invented and wishes to put in operation a chemical and mechanical criterion for preventing and detecting forgeries, more difficult to counterfeit than any other plan or contrivance ever yet invented for that purpose;"—that it is "not applicable to bank-notes only, but also to drafts, checks, bonds, wills, powers of attorney, stock, and other certificates;"—and that he believes it will, when brought into operation, "put a complete and entire end to forgery." The petitioner prayed that a committee might be appointed to receive proofs of the efficiency of the invention; but this reasonable request *has not, we regret to* say, been complied *with.*

There is a patch of ground, at Nether belonging to Earl Fitzwilliam, under whi of coal has been on fire for several years. . have been made to extinguish this subt furnace, but without effect, and when (will end seems impossible to guess. Soi ago a number of the industrious inhabitaı village of Greesbro, bethought themsel what had seemed, and was in fact, a ı might be turned to advantage, and hav tained the land over the fire to be laid ou den patches, it is from thence that for so has been obtained the finest early potato have been sold in the Rotherham and ı markets.—*Sheffield Iris.*

Mr. John Vallance had a patent some y for packing hops in iron cases. If ever tri was the result? Any particulars relativ method and the consequences would, p much oblige many others besides the in G. A.

The "Problems in Practical Surveying, Mr. F. wishes us to submit to our readers really no difficulty whatever. The secon stance, which he imagines can only be we with the help of fluxions, requires but a kn of common arithmetic. Here (for his pri nefit) is our way of disposing of it:—

$$96 \times 82 = 8772, \text{ area of the fig. A B C}$$

$$d\,P = 465 - 82 = 383,$$

$$\frac{8772 \times 2}{465} = 37.729 = C\,M.$$

$$P\,C : C\,M :: P\,d : n\,d,$$

$$\therefore \frac{37.799 \times 383}{465} = 31.162 = n\,d.$$

Mr. C. Hyde, of Horsley, surveyor, de will acquaint our readers that he is about lish a "New System of Plane Trigonome which he will show how the case proposec in the Mechanics' Magazine, May 5, 1832 similar cases of surveying, may be solvec statings instead of by four—which he alle the usual practice. We suspect, however, Hyde's system will not prove to be so "ne imagines—so far, at least, as regards the question. In all the respectable works o nometry, with which *we* are acquainted problems are to be found, solved by two s indeed, where the perpendicular altitude o ject only is required, we have never seen n two employed. The work of Davis on L veying, which Mr. Hyde quotes in evide contrary practice, we have not seen; but heard it indifferently spoken of, by very co judges.

From a series of experiments made by ı ety of Arts, it appears, that the dried s of the algaroba tree of South America (*pallida*), might form an excellent substi oak bark in tanning; the proportions of power possessed by the two materials bein lows—algaroba 4.6, oak-bark 1.

The "Description of a New Portable Blc is intended for insertion.

Communications received from Mr. Woo Mr. Halligan—Mr. Watson—G. L. R.

The Supplement to Vol. XX., with a of William Symington, is now ready, p also Vol. XX., complete, in boards, price

LONDON: Published by M. SALMON, Mechanics' Magazine Office, No. 6, Pete Court, between 135 and 136, Fleet-street for the American Edition, Mr. O. Rich, Lion-square. Sold by G. G. Bennis, Neuve, Saint Augustin, Paris.
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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 568. SATURDAY, JUNE 28, 1834. Price 3*d*.

CHILD'S UNIVERSAL ROSETTE.

Fig. 1.

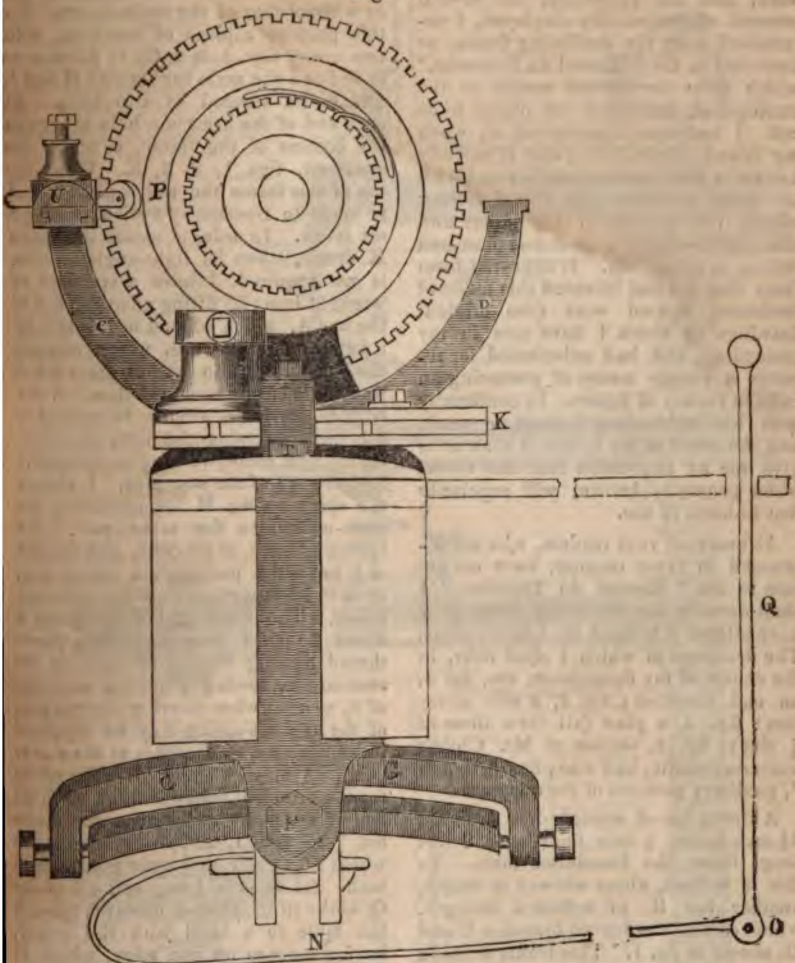


Fig. 4.

IMPROVED ROSE-WORK, AND "UNIVERSAL ROSETTE."

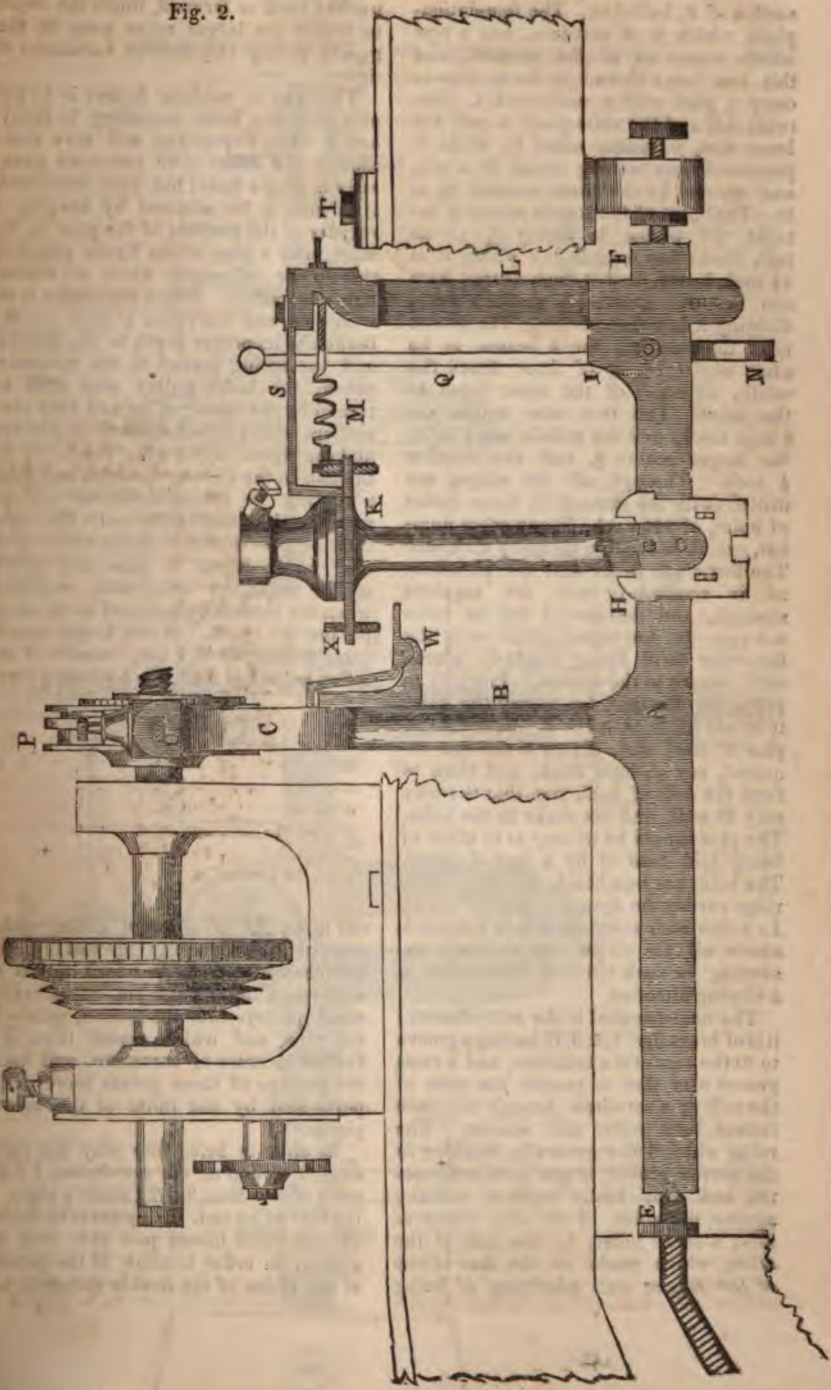
Sir,—Having a wish to add to my turning-lathe some apparatus for rose-work, and not approving, for several reasons, of that usually employed, I determined to try the oscillating frame, as described in the "Manuel du Tourneur," which gives the figured motion to the cutting-tool, instead of the object to be cut. I had nearly completed it, when my friend, Mr. Child (who is already known to your readers), saw it, and with his usual kindness and liberal feeling offered me the use of his papers and ideas on the subject, as it had occurred to him in earlier life. It appeared from them that he had invented this mode of producing figured work (the original drawings of which I have now in my possession), and had substituted for rosettes a simple means of producing an infinite variety of figures. In conformity with his instructions I went to work, and the result of my labour is such as to give me an impression that this mode, when generally known, will supersede that hitherto in use.

As many of your readers, who are interested in fancy turning, have not access to the "Manuel du Tourneur," I shall describe the oscillating frame as I have altered it to meet Mr. Child's ideas. The drawings to which I shall refer, in the course of my description, are, fig. 1, an end elevation; fig. 2, a side elevation; fig. 3, a plan (all these three of ¼ size); fig. 4, section of Mr. Child's universal rosette, half size; figs. 5, 6, and 7, auxiliary portions of the apparatus.

A strong bar of wrought-iron A, fig.2, 1¼ inch broad, ⅝ inch thick, and 2 feet long, forms the foundation-shaft. To this is welded, about midway in length, another bar B, of sufficient strength, which carries the curved branches C and D, shown in fig. 1. This frame is made so as to be put into the groove in the gantry (which should be about 2 inches wide), and is supported by two centres, E and F, one in the end of the lathe-frame, and the other fitted into the gantry groove so as to slide in it, and to be fixed by a screw above it (T). The summits of the branches have square parts, so that a sliding piece (U) may fit either of them, which carries the roller or rubber for working the rosette figures. The width between the ends of the branches is 9 inches. The slide-rest is fixed on a frame placed on and at right angles to the bar A, and has an oscillating motion of its own, to be used either with or without that of the main frame. For this purpose a piece of cast-iron, with two arms, figs. 1, 2, 3, G, is fitted so as to slide on the main bar betwixt H and I, and to be secured by two keys. At each end of the arms is a hole to receive the centres of the frame, carrying the slide-rest, figs. 1, 2, 3, K. Upon the top of this frame the rest is placed, and is made to traverse by a slide, having a set screw. In order to secure the frame K firmly, when its right-angled motion is not required, I have a standard of wrought-iron (L) fitting upon the end of the bar A, which is fixed in its place by a key through its ends, which embrace the bar, and fit into shallow grooves in it so as to keep the standard firm. A thin bar (S), having a groove, is screwed to the piece carrying the rest, and is secured by a screw working in the groove into the top of the standard. I also fix the spiral-spring M for regulating the cross-motion to the same part. The spring has five or six coils, and one end of it has a flat part with a square hole, so as to be slipped on to a pin in the rest-frame. The other end of the spring is about 4 inches long, and has a screw-thread passing through a hole in the standard L, having a nut on each side of it, so that when altering the positions of the rest the spring may be regulated in conformity, so as either to draw or to push, as may be required. The spring for the principal frame is fitted on to the end of the main bar close to the standard (see figs. 1, 2, 3). N is a socket which fits tightly, and a pin goes through both. At O is a joint, and a thin bar Q works in it, passing upwards through the table to a level with the gantry, having notches on one edge, which fit upon the edge of a plate screwed to the table, and a wedge keeps it steady. The action of this spring is to pull either of the arms of the frame C and D (carrying the roller slide) up to the rosette, to give the figure.

Having thus far described the frames, I will go to the contrivance, to which, from the infinite variety of figures it is capable of producing, I have given the name "Universal Rosette." Fig. 4 is a

Fig. 2.

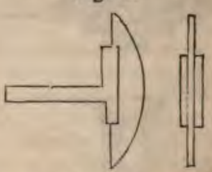


section of it, half-size. The foundation-plate, which is of cast-iron, has a boss which screws on to the mandrel, and this boss has a thread on the outside to carry a plate with a screw-socket. Betwixt this and the main plate is put the brass disc, or rosette-wheel P, which is prevented from turning round by a pin, and secured by the plate screwed up to it. That part of the rosette which is betwixt the plates, is nearly $\frac{3}{16}$ of an inch thick; but outside the plates it is $1\frac{1}{8}$ inch broad, and $\frac{5}{8}$ inch deep. This rim has two grooves, $\frac{1}{2}$ an inch deep, dividing it into three ridges. The groove next the maudril, for a reason to be after explained, is of three times the width, although of the same depth as the other. The two outer ridges are $\frac{1}{8}$ inch thick, and the middle one $\frac{1}{4}$ inch; the larger groove $\frac{3}{8}$, and the smaller $\frac{1}{8}$ inch. Through all the ridges are drilled (with the same drill) three circles of holes, of 144 each, or any other number, which is capable of many divisions. The first circle is as near the periphery as is consistent with the requisite strength, and the second has its holes not opposite, but intermediate with the first—the third being similarly placed with regard to the second. Previous to preparing the drill for boring the holes it is advisable to make a few dozens of pins of steel wire, drawn to the size required, say $\frac{1}{16}$ inch thick, and then to form the drill of such size that the wire may fit well, and not shake in the holes. The pins should be so long as to allow of being laid hold of by a pair of pliers. The holes are numbered, and the middle ridge carries the figures engraved on it. In a line with every sixth hole is a mark across all the ridges, the numbers answering for each circle of holes taken in a sloping direction.

The next essential is the roller-carrier: it is of brass, figs. 1, 2, 3, U, having a groove to fit the tops of the branches, and a cross groove over that to receive the stem of the roller; a set screw through the piece fastens both roller and carrier. The roller which I use generally, working in the narrow groove, is one inch in diameter, and runs freely without rubbing against the sides. I use also, occasionally, a small roller, by the side of the other, which works on the face of one of the ridges, and admitting of being pushed back or forward, limits the depth to which the larger roller goes in the groove, giving very curious variations of figure.

The way to produce figures is to put pins into the holes according to fancy, and a little experience will give some idea of the effect to be produced generally in single lines; but when combined, it is only to be attained by keeping a register of the position of the pins in the holes, with a copy of the figure attached thereto for reference, when a similar figure is wanted. When the rosette is set with pins, and the roller placed on the branch to its proper depth in the groove, and the spring placed to the necessary power, the lathe pulley may then be turned by the hand, or by any very slow motion, either by wheelwork or pulleys, and the figure is cut upon the work by the tool in the slide-rest, which oscillates according to the undulations of the figure:—thus, the spring pulls the roller into the groove till it meets with a pin, over which it has to pass, and which makes the roller retrograde, returning when the pin has passed, and so on, completing the circle. When larger curvatures are required, I use, instead of the roller, a piece of steel, fig. 5 (about $\frac{1}{4}$ size),

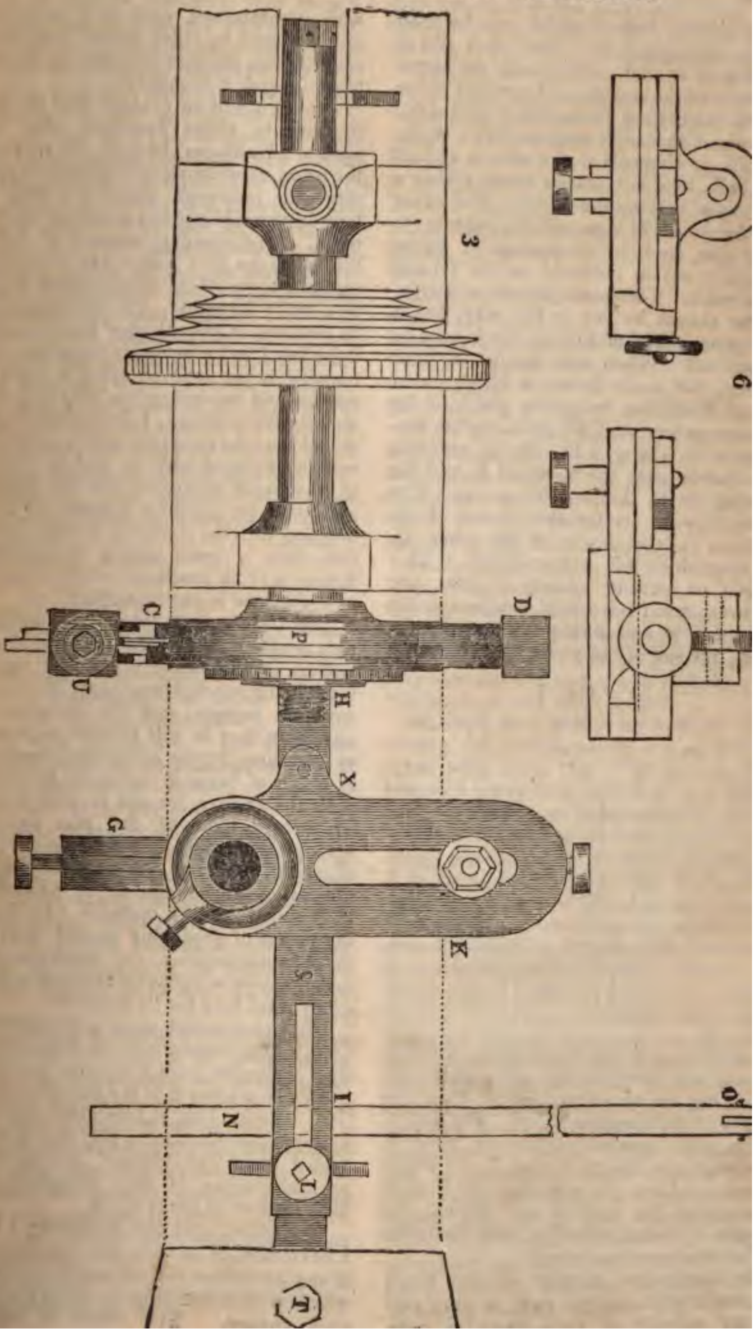
Fig. 5.



cut to an arc of a larger circle, which prevents the necessity of making the branches so wide as to admit rollers of such magnitude: I also put, occasionally, small pulleys into the groove, which fit the pins, and which permit thus of a further increase of curvature, and make the passage of those points more easily performed by the roller or the curved pieces.

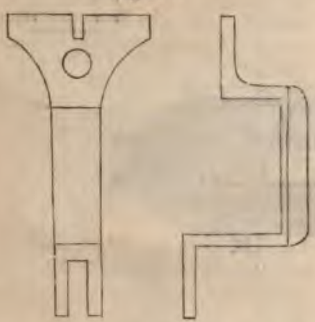
In order to bring into play the right-angled motion of the rest-frame, I fix a piece of cast-iron, fig. 7 (about $\frac{1}{2}$ size), to the foot of the rest. This piece is so shaped as to have its lowest part even with the gantry, in order to allow of the passage of the slides of the double excentric and

IMPROVED ROSE-WORK, AND "UNIVERSAL ROSETTE."



oval chucks, both of which can be used with this apparatus. The other end of this part extends underneath the larger groove of the rosette, and carries a roller fixed in a sliding frame, fig. 6 (full size), by which the roller may be drawn backwards or forwards to the extent of half an inch, by a micrometer screw, giving a means of varying the figure. The effect of the spring M is to pull the roller up to the pins, and so to produce a figure which is cut or indented on the face of the work. The same extent of curvatures cannot be cut in this way, but a great variety of minute patterns may be produced. When this motion is used alone, the main frame A is prevented from oscillating by a stop put into the gantry groove, and the right-angled motion is at liberty. The fixing arm S is unscrewed from the standard L, and the spring set to the needful power. The pins may be set for that groove if required, independently of the other, by having them of shorter length. This mode of cutting merely indents the figures; but I have this contrivance for reversing it, and giving the figure in relief; instead of the piece, fig. 7, carrying

Fig. 7.



the roller, and which is fixed to the rest, I use one carrying the same roller, but working on pivots projecting from the stem of the branches at W. The end of this piece receives motion by a screw through the foot of the rest X, by which means I have an additional lever, thus reversing the motion and leaving the figure in relief, affording very beautiful and uncommon varieties.

The compound motion of the main *frame and right-angled* part is very curious, and admits of very singular cuts with intermissions, such as I never yet saw produced by other means, requiring considerable practice to pursue to the extent of which it is capable.

I think it will be evident that the improvements above described offer important advantages, beyond the scope of the usual cumbrous and expensive apparatus for rose-work which has been so long in use without any material amendment. The designs, instead of being limited to ten or a dozen, are absolutely unlimited, and their development might be a study for years. The apparatus can be removed in five minutes' time, and the lathe left free for ordinary purposes, the mandril being relieved from a mass of rosettes and encumbrances weighing frequently 60 to 80lbs. I have already observed that the excentric and oval chucks can be employed with it; and by a train of wheelwork connected with Mr. Child's apparatus for dividing ellipses, communicating with the revolving cutters in the tool slide, a great variety of cycloidal figures may be produced, which I intend at my leisure to put into effect.

The Universal Rosette will produce polygonal figures, which are beyond the powers of the old engines, the curvatures being much deeper than their construction permits; and the varieties of curvature may be still further increased at pleasure, by the occasional insertion of pieces of brass of sufficient thickness to fit the grooves, secured in their places by two or more of the pins passing through them: these pieces being cut into elliptical, parabolic, or other curves in alternation in the same figure, according to the taste of the operator. In short, the means of producing curved lines by these combinations are inexhaustible, and the man of patient investigation may never want food for its exercise.

I have trespassed upon your patience by this long description; but I have been thus particular from a wish to do every justice in my power to my friend's invention, which, with others that he has kindly communicated to me, would have passed away with himself, having now, in the evening of life, comparatively little interest in works of art.

On looking over the foregoing, I find I have omitted to state that the foundation-plate of the rosette carries a division wheel with a screw nose, having a catch and spring. The wheel is cut into

teeth of various numbers, four to six teeth to each number, all worked by the same catch, for the purpose of crossing the figures, and which being used already in rose engines, needs no further description. It may not be amiss to observe to beginners in this kind of work, that by changing the roller from one of the branches to the other, and adapting the spring accordingly, a reverse of the figures is obtained, and by raising the cutting tool above the centre of the mandril, or depressing it, the figures are placed at an angle to the radius, with, frequently, very pretty effect.

Should the length of this epistle not indispose you to receive further communications from me, I will send you drawings and description of an engine for cutting wheels of various kinds, that I have now finished and got to work, which I think offers some advantages that may be useful.* The principle was given to me by Mr. Child. I am, Sir, &c.

R.

Halifax, May 30, 1834.

MR. NUTT'S APIARIAN SYSTEM.

Sir,—If your fastidious correspondent, J. P. T., expects to write down Mr. Nutt's much and justly admired book on the humane management of honey bees, he will find he has undertaken a task he never will accomplish. He may rest assured that, in despite of his senile efforts, Mr. Nutt's system of bee-management is rapidly progressing—is patronised by many distinguished noblemen, and has been pronounced by several scientific individuals—aye, and *societies too*, to be one of the most humane and praiseworthy discoveries of the present day. A second edition of Mr. Nutt's book, notwithstanding its worthlessness in the estimation of J. P. T., is called for.

I will not occupy ten columns of your Magazine by remarks in refutation of J. P. T.'s ten columns of frivolities, but content myself with a brief notice of a few only of his puny criticisms.

Before he commences his attack upon Mr. Nutt, he professes himself to be a bee-master, and says, emphatically, that "he will stick to *his* order;" and then goes on, through nine *long* columns, to carp and cavil at *the very cleverest practical apiarian* of the day. Is not this *sticking to his order* with a vengeance?

He next tells us, that "to make allusion to the Deity," as Mr. Nutt has done, "to say the least of it, shows very bad taste." *De gustibus non disputandum.* For my own part, I must say that, after a very careful perusal of Mr. Nutt's book, I cannot find that he has any where irreverently made mention of, or lightly or indecently alluded to, the Deity.

To abate four-fifths of the "astonishment" expressed by J. P. T. in his next paragraph, he should consider that, if "one clergyman wrote part of the book, and arranged the whole for publication," the four other clergy—"men" *he* talks of —but of whom the book says not a word—could have nothing to do with its arrangement; nor is it at all astonishing to *Christian* readers, that a *clergyman* should allow a passage containing an allusion to the Deity to appear in print.

Next, we are told by J. P. T. that Mr. Nutt, "in dedicating his book to the Queen, only follows the example of Wildman." In dedicating his book to the Queen, Mr. Nutt did so by *her Majesty's permission*, and not in imitation of Wildman, or any other person.

Mr. Nutt says, and every apiarian deserving the denomination will cordially agree with him, that "by uniting the bees of a heavy hive with those of a light one, the light one being already incapable of supporting its own population, many persons have failed of success." J. P. T., as if in haste to find fault, observes upon this:—"The very next time, however, Mr. Nutt opens his mouth, he gives this oracular dictum of his the most flat contradiction." Does he, indeed!—What a pity! But let us have it; well, here it is—"Your lordship's three rich hives will receive the numerous bees of the three weak ones; and they will, *notwithstanding such additions to their numbers, be in a state of prosperity, and ALL your bees be in the greatest safety.*" Now, so far from this being "a flat contradiction" of the above quoted words of Mr. Nutt, I maintain that it is in perfect consistency with them,—that it is wrong to unite the bees of a rich hive to those of a poor one; but that it is right, and sound, good, apiarian practice, to unite the bees *of a poor hive* to those of a rich one.

* *We need scarcely say that we shall be glad to receive them, or any other communication from the same quarter.—Ed. M. M.*

After this, J. P. T. may, harmlessly enough, write all manner of nonsense, tell us, on Huish's authority, that bees exposed in a glass hive in an atmosphere 20 degrees below freezing, *continued very lively ! !*—that Mr. Nutt never can have taken any thing like the quantity of honey in one season, from one colony of bees, he has stated, because *he* (J. P. T.) never could get above 30 lbs. from a hive, though such hive was 500 cubic inches larger than one of Nutt's boxes ! !—that "the Rev. Mr. Clark says his hive was given him by Mr. Nutt," though he says no such thing ;—that, "whatever Mr. Nutt may say respecting storifying, it was thought differently of in the year 1675 !" (very likely ; but what would it have been thought of, if Mr. Nutt's boxes had then been opposed to it?)—that "Mr. Nutt has contrived to mystify the description of his hive ;"—that "he wastes all his time in describing three drawers," &c. &c., whereas he no where makes mention of more than *one* drawer.

If J. P. T. cannot understand the description of Mr. Nutt's hives, he may see and examine a complete set of collateral boxes in the Adelaide Rooms, at the Museum of Arts, Liecester-square, at 131, High Holborn, or in hundreds of places in and about London ; and until he has done so he had far better lay down his pen.

J. P. T. is a straw-hive stickler, prejudiced in favour of straw-hives, and yet "they have never yielded him more than 30 lbs. of honey at one time !"

Hoping I have said enough to make him see the absurdity of his attack on Mr. Nutt, if not to make him express his sorrow for his rashness,

I remain, sir,
Your humble servant,
K.

[We wish the defenders of Mr. Nutt's system would address themselves more specifically to the matters of fact involved in the case, and also more dispassionately. We are not ashamed to confess, that the criticisms of J. P. T. have caused us to doubt the correctness of the favourable opinion we at first expressed of Mr. Nutt's book ; and we should be very glad to see it a little more clearly made out, that there is really nothing in them.—Ed. M. M.]

BARTON'S METALLIC PISTON.

Sir,—I have no objection to Mr. Baddeley's *preference* of Messrs. Heatons' *"Improved Metallic Pistons;"* but when *such preference is given*, manifestly unjustly, and when that is made extensively known, through the medium of your highly respectable and valuable publication, I have some reason to complain. Your readers will scarcely believe that if there be any improvement upon my patent (which, by the way, I deny), I am, myself, the author of that improvement ; for the very pistons, so highly lauded by your correspondent, were, in the first instance, made by me for the Messrs. Heatons.

It was my intention to have answered your correspondent at greater length ; but, after having conversed with numerous individuals competent to judge upon the subject, I have resolved not to trespass upon your space further than to request your insertion of this note, together with a few (out of hundreds) certificates, which I have in my possession, to prove the entire efficacy of *my* metallic piston. I have selected, for obvious reasons, those of most recent date.

I will, however, just observe, that I have fitted my piston in upwards of forty large engines for the Government, varying from forty to one hundred horse power, and that I am, at this moment, supplying the Government in the same manner. I have supplied also many Liverpool and Irish steam-vessels, and thousands of engines in almost every part of the country. Nor have I ever found my pistons fail, when they were of my own construction, and under my own control.

I am, sir,
Your very humble servant,
John Barton.

Providence-row, Finsbury-square,
June 24, 1834.

Fountain Mills, Bermondsey,
June 13, 1834.

Sir,—I have the pleasure of informing you, that the new piston has been at work several days, and answers remarkably well ; and that the 16 inch one you made for us some months back has been going ever since, without a fault. I think them superior to any other metallic pistons, from their simplicity, which renders them less liable to get out of order, and, consequently, their durability is increased.

I remain, sir,
Yours respectfully,
G. W. Turner.

Mr. Barton.

Mr. Barton,

Sir,—I am happy to inform you of the excellent performance of your patent metallic piston, and stuffing-box, in our high-pressure steam-engine,

hough it works at a pressure of 600 to the square inch, and has been in daily use o years, is not yet out of order. It has nined twice during the above period, and in the most perfect order. I have no in stating, that it is likely to last for rs.

I am yours, &c.
WILLIAM HEARN,
Engineer at the National Gallery of Practical Science.

, 1834.
n.

Thames Tunnel.

'e have used your metallic pistons above rs, with every satisfaction, and find them ior to any metallic piston, in point of ırability, and economy, as the one we orking has been in use above four years, equiring repair, and we have no doubt above ten years more. We have used rts of metallic pistons, but never found ıwer but yours.

WILLIAM TILLET,
Engineer.

, 1834.
n.

Barton, June 24, 1834.

our metallic piston answers exceedingly worked for nearly thirteen months, withg the cylinder-cover, and then was in rder. It has been in constant work sixhs, and is as good as the first day I put it

I am yours respectfully,
ROBERT SCOTT,
Engineer to the Printing Department, Excise Office, Old Broad-street.

NCE IN SCALES OF MEASUREMENT.

-Allow me to observe, in reply to arks of your correspondent, Mr. ıdrews (inserted in your Maof June 14), that, until a mediscovered of preserving ivory ıe influence of heat and cold, rill always be different degrees ıracy in ivory scales. Mr. Anis in error when he says that screpancies might be avoided by ent-makers adhering to one ceriındard, as it is well known by ho are acquainted with the naivory, that parts of the same ill be differently acted upon by d cold. At the same time it is ınt to be asserted, that temperaıld produce so great a variation mentioned by your correspond-Every scale divider has his own or standard, which he considers there may be—there undoubt-—*minute variations* in these but, *certainly*, never so great as .34 of an inch in a foot. It is to me perfectly unaccountable. This I can assert, that in thirty years, during which time many thousands of scales have passed through my hands, I never saw in any, intended to be of the same measure, any thing near so great a variation as .34 of an inch to a foot. Were such variations frequent, it would render ivory scales worse than useless.

If Mr. Andrews will favour me with a sight of the scales he alludes to, I would pay the carriage both ways, and should feel obliged.

I remain, sir,
Your obedient humble servant,
W. ELLIOTT.

268, High Holborn, June 24, 1834.

Sir,—The difference between the two scales adverted to by your correspondent Mr. Andrews, if such really does exist, must be purely accidental; but as .34 of an inch on such a scale is equal to 170 links, or ten times the quantity stated, it is probable that .034 should be taken as the amount of discordances between them.

The circumstance that a common standard of measure is made use of by all workmen employed in the construction of rules is already well known, and with those who hold any pretensions to accuracy, the disagreement between any two of the original scales from which even common work is copied, can hardly, in one foot, exceed the five hundredth part of an inch.

Among ivory scales the inequalities for the most part arise from an unequal alteration of length after the divisions have been cut, and to such an extent is this the case, that a few weeks will sometimes suffice to destroy every thing like identity between scales that have been carefully copied from the same pattern.

Aware of this circumstance the most eminent professional men have either abandoned the use of ivory altogether, or by procuring a metallic standard, put themselves in possession of the means of detecting errors, and applying the necessary correction.

Your obedient servant,
W. SIMMS.

136, Fleet-street.

STEAM-CARRIAGE FOR GERMANY.

On Wednesday last a steam-drag, built by Mr. Walter Hancock for a scientific German gentleman, was put on its first trial. It started from Stratford, at three o'clock, with a four-wheeled carriage behind it, passed through Bow, Old-Ford, Hackney Wick, Homerton, Clapton, Crouch-End, Stamford-hill, and the Green Lanes, to the Queen's Head, Tottenham; and came back through Ball's-pond and Islington to Mr Hancock's steam-carriage station, in the City-road, where it arrived after a run of about 12 miles, which it performed with great regularity, and to the entire satisfaction of the gentleman for whom it was built and his friends, who accompanied it. A part of the distance was done at the rate of 14 miles an hour, and the hills ascended at the rate of 9 miles an hour.

The terms of the contract for building it were, we understand, that it should carry six persons besides the attendants, or that it should carry the attendants only, and draw after it a separate four-wheeled carriage, with four persons, at the rate of from 10 to 12 miles an hour. The rate of speed was considered to have been exceeded, although the drag itself contained more than its full load—7 passengers and 3 attendants, the attached carriage carrying 6 passengers also, making *more than double the number contracted for.*

EXPERIMENTS WITH MR. GODFREY KNELLER'S EVAPORATING APPARATUS.

We have been favoured with the following account of a series of experiments made with the patent evaporating process of Mr. Godfrey Kneller, described at page 172, of our present volume.

One hundred gallons of water were brought to the boiling heat, 212°; on passing it into another vessel the heat was found to be 196°. The evaporating machine was then set in motion, and in 5 minutes the heat was reduced to 158°; in 30 minutes more to 126°; and in 25 minutes more to 85°; being 111° in all within the hour, while the quantity evaporated amounted to 25 per cent.. *It was extraordinary, too, that the vapour was so* HOT AND DRY, *that it would not damp a piece of lawn paper held in it.*

Had this experiment been tried on *syrups, worts, or brine,* the advantages of the process would have been more apparent. In the case of worts, the continued supply of compressed air drives off the carbonic acid gas, and effectually prevents the ascetic fermentation even in the hottest weather.

Another experiment was made, and the evaporator set in motion *in the copper* at the heat of 172°. This was continued for some time with the strongest fire that could be applied in the fire-place, and a square shallow copper, well adapted for the purpose; but the heat of the water *could not be raised* above 173° or 174°—the action of the machinery completely counterbalancing the greatest elevation of temperature that could be produced. In this case the evaporation was so great as almost to exceed belief. That 36lbs. of water, on the square foot, can be evaporised in one hour, at a temperature not exceeding 172°, Fahren., is such a result as has never, it is believed, been before realized, or even supposed to be attainable.

Innumerable are the processes in the arts which will be facilitated and improved by this combination of rapidity of evaporation with a low temperature; but there is perhaps none which it will effect so beneficially and extensively as the manufacture of salt. This necessary of life—so necessary that no substitute can be found for it—may now be manufactured on any part of the sea-coast at a trifling expense. The formation of salt by this method commences at the low temperature of 90 degrees or under, when the evaporation becomes 140 times greater than that temperature would produce without the vibrating action, and the crystals produced are of the purest and finest quality.

The power of this means of evaporation, of course, depends on the number and size of the air-boxes or chambers employed; but their geometrical construction affords the capability of using a large number in a small compass.

ALDERSON ON STEAM AND THE STEAM-ENGINE.*

The pretensions of the work before us are of a description to provoke, if not to

* An Essay on the Nature and Application of Steam: with an Historical Notice of the Rise and Progressive Improvement of the Steam engine. By M. A. Alderson, Civil Engineer. Being the Prize Essay on this subject at the London Mechanics' Institute, for the Year 1833. London: 124 pp. 8vo. Sherwood and Co.

justify, considerable notice. According to the author himself, it is "a brief and comprehensive treatise, embodying the principles and application of this powerful agent in *all* its branches," and em-embraces "*all* the successful improvements made by the engineers and projectors of the present day, together with those of their predecessors."—*Preface.* We are further modestly assured by the same very impartial authority, that herein "the economy of which it (steam) is susceptible, as far as its power has hitherto been developed, and the various modifications that have taken place in its mechanical application, are *clearly* and *succinctly* detailed, and placed in juxta-position, and their utility and worth *duly* estimated."—*Ibid.* We are informed, moreover, that "this Essay was honoured by the award of the *highest* premium ever yet given by the London Mechanics' Institution," and that it received on that occasion the "encomiums of *high* scientific characters, who are known to *thoroughly understand* the nature of the subject here treated off."

Leaving the author's own estimate of his own performance to speak for itself, let us see who were the "high scientific characters" who are "*known* thoroughly to understand the nature of the subject treated of," and whose "encomiums" are paraded as if they formed of themselves a sufficient passport to public favour. The gentlemen alluded to are Dr. Lardner and Dr. Birkbeck,* of whom all that is "known," as regards this particular subject, is, that Dr. Lardner is himself the author of a Treatise on the Steam-engine, which happens to be one of the most practically useless that ever was written; and that Dr. Birkbeck is also himself the author of a work on the steam-engine, not much better; or to speak more correctly, of two or three Parts of such a work, which were so little thought of by the scientific world that more were never called for, and more were never published. But as a man may be a good judge of music without knowing how to play on the fiddle, so may learned doctors be able to tell when a book is good, without being able to write one. Although, therefore, the "known" qualifications of Drs. Lardner and Birkbeck, as regards the special matter in hand, are such as to impart but small weight to their "encomiums," it becomes necessary, in justice to Mr. Alderson, that we should take a glance at the reasons they have given in support of them.

The Essays with which this of Mr. Alderson had to compete were four in number, and, speaking of them, Dr. Lardner is stated to have observed,—

> "He could safely say, from a pretty extensive experience in examining manuscripts from persons of the highest pretensions, that the very worst of them exceeded the ordinary standard, even in purely literary qualities. Each of them contained a clear and satisfactory account of the nature of steam-engines, written with surprising ease and facility, collecting together all the facts, and arranging them in clear, distinct, and well selected language. The ground of preference (in favour of Mr. Alderson's Essay) was not only the superiority of the materials, but its being, as a whole, more clear, and written in a better literary style, with superior drawings."—*Preface.*

The first branch of Dr. Lardner's "ground of preference" is the superiority of Mr. Alderson's Essay in point of "materials;" but since he affirms of "each" and every one of the competing Essays, that they contained "*all* the facts," we think it may be fairly asked, where Mr. Alderson found the "materials" for that superiority? Could his Essay possibly include more than "*all* the facts" belonging to the subject? Not content with discovering more matter in the Essay than any man could cram into it, Dr. Lardner is pleased to say of the manner of it, that it is, "as a whole, more clear, and written in a better literary style" than any of the others,—that is to say, he thinks the four unsuccessful Essays were each written "with surprising ease and facility;" and in "clear, distinct, and well-selected language;"

* The work is inscribed to this gentleman, in a Dedication, in which he is gravely assured that his name is "*illustrious in the arena, and almost synonymous with science*"! Were it not that Dedications are usually considered sacred from criticism—in deference, we presume, to the universal understanding that they are never meant to indicate more, than the measure which one man takes of another man's modesty—we should be disposed to ask *how* the name of Dr. Birkbeck has become "almost synonymous with science"?—what the valuable contributions are which he has made to science, and where they are to be found recorded? —with what single *invention or discovery, or improvement, in short, his name is*, even in the *slightest degree, identified? That* Dr. Birkbeck *has proved himself a good friend to science*, is *beyond dispute; but to be a friend*, and a man, of science *are two different things.*

but (of course) that this of Mr. Alderson's is written with *super*-surprising ease, facility, clearness, distinctness, and so forth. The Doctor's eulogy is altogether of so extravagantly fulsome a cast as to defeat its own purpose. No sensible person can pay the least heed to praise so lavishly and indiscriminately bestowed.

Of Dr. Birkbeck's " encomium " all that is reported is the following brief sentence:—

" Dr. Birkbeck observed, that the author of the successful Essay had discovered two notices of this power which *had escaped preceding writers*; and he had also detected, in Homer's description of the Phæacian fleet of King Alcinous, in the eighth book of the Odyssey, an allusion to navigation in his kingdom, which is no inaccurate description of steam navigation."—*Preface.*

The two notices here alluded to are as follows:—

" It is a singular fact, that in later times Sir Isaac Newton hit upon a similar contrivance to demonstrate the expansive force of steam, or, as he expresses it, the elastic power of vapours—as we find by reference to a work entitled " An Explanation of the Newtonian Philosophy," at page 199, and paragraph 790, which reads as follows:—

" The quantity of elastic vapours produced by the action of the fire will appear by the æolipile, which is a ball with a tube fixed in it, having a hole whose diameter is not quite the twentieth part of an inch. Let this ball, partly filled with water, be laid upon a fire, the moment the water is changed into vapour, those vapours go through the hole; but if the heat be so increased as to make the water boil violently, the vapours compressed in the upper part of the ball will, by their elasticity, endeavour to recede from each other every way, and violently rush out through the whole. We have a more sensible effect of the elasticity of vapours if the hole be made bigger and stopped, and then laid upon the fire till the water boils violently; after this, if the ball be set upon little wheels, so as to move easily upon a horizontal plane, and the hole be opened, the vapours will rush out violently one way, and the wheels and the ball at the same time will be carried the contrary way."

" *Here we have a complete steam carriage by Newton on Hero's principles.* THE ILLUSTRIOUS NEWTON, THEREFORE, IT APPEARS, WAS THE INVENTOR *of the Steam-carriage.*" —p. 16.

2. " The first engine of which we read is the one described as the invention of Hero, and it is generally stated in histories of the *steam-engine, that from the period of Hero's invention down to about the year 1563, no mention occurs, in any work, of steam as a First Mover;* but in opposition to that opinion, it must be stated that *we* find, in Malmsbury's History, under the date of 1002, the following paragraph:—

"' In the Church of Rheims are still extant, as proofs of the knowledge of Gerbert, a public professor in the schools, a clock constructed on mechanical principles, and a hydraulic organ, in which the air escaping in a surprising manner by the force of heated water, fills the cavity of the interior of the instrument, the brazen pipes emit modulated tones through the multifarious open tubes.'

" This really appears to be the earliest ' modern' application of steam, and *it is rather surprising that it should have been so long overlooked.*"—p. 17.

With respect to the first of these notices, we agree with the author that it would indeed be a " singular fact"—if fact it were—that none of all the innumerable admirers and followers of Sir Isaac Newton, had ever before discovered that, to his many titles to immortality, he added that of being " the inventor of the steam-carriage." Well might Dr. Birkbeck—if such were the case—feel proud at the thought of presiding over an institution which had been the means of rescuing so " singular" a " fact" from oblivion! And well, too, in that case, might those who conferred on Mr. Alderson " the highest premium ever yet given by the London Mechanics' Institution," think him deserving of that high distinction! But, unfortunately for Mr. Alderson's scientific reputation, and unfortunately for the critical sagacity of his judges, this " singular fact" is wholly without foundation. Mr. Alderson could not himself have seen the work which he quotes in evidence of it; he must have obtained his extract from it at second hand; and been deceived by those who gave it to him, as to its character. We have the work alluded to now before us, and find at the page indicated by Mr. Alderson, the passage quoted above; but although the book is styled, and correctly enough styled, " An Explanation of the Newtonian Philosophy," it by no means professes to give Newton's opinions and experiments alone. The author, on the contrary, distinctly cautions the reader, in his Preface, against falling into any such mistake. " I have not followed," he says, " the opinion of Sir Isaac Newton in every thing," and " there are many inventions of other persons contained in this our treatise." The work, in fact, is nothing more than the well-known work of Dr. Gravesande on Experimental

phy, consisting of "Lectures read outh of the university of Leyden," originally in Latin, and translated glish in 1735; and to ascribe ing contained in it to Newton, is absurd as it would be to say ckstone is the author of the English Constitution, because he wrote Comes upon it. For any thing that the particular application of the e of the æolipile, on which Mr. n lays so much stress, is as likely been devised by Gravesande as ; and, after all, it has no more o the character of a "complete arriage" than the vane of a steeple be considered a complete wind-cause, like the mill, it is turned wind.

econd notice as to the passage in sbury is all perfectly correct, ex- to the surprise expressed "that ld have been so long overlooked." ssage quoted was pointed out in irnal above seven years ago, (vol. 255,) and we dare say by many before us.

much, then, for Dr. Birkbeck's mium," as far as it is founded on t, that "the author of the success- ay had discovered two notices of wer, *which had escaped preceding s*."

passage in the Odyssey (Pope's), cted" by the author as prefiguring cy what steam navigation has ac- realised, is certainly very remark- It seems as if actually written he event.

alt thou instant reach the realm assign'd
rous ships, self-mov'd, instinct with mind;
* * * *
clouds and darkness veil the encumbered

s, through darkness and through clouds
ly,
mpests rage, tho' rolls the swelling main—
s may roll, the tempests swell in vain;
e stern god, that o'er the waves presides,
they pass, and safe repass the tides,
ry burns; while careless they convey,
cuous ev'ry guest to ev'ry bay."

will probably now be considered time that we should make the r acquainted with what we our- think of the work before us. Mr. son styles himself, in the title of it, E." How he came by the degree now not; but we shall assume that ained it by a fitting course of study probation, and judge of his present production accordingly. Now in our humble opinion it is such a work as no *properly qualified* "C. E.," possessed of a becoming share of modesty withal, would ever have thought of inflicting on the public. Its claims to the honour of the "highest premium ever yet given by the London Mechanics' Institution" we do not dispute—we dare say it was the best of the lot; but that it should therefore have been printed and published, and at a very costly rate, for universal circulation, and thought likely to do honour to the profession of "C. E.," we must take leave to consider as a very serious mistake. It furnishes scarcely any new information on the subject of which it treats—omits much that, though old, ought to have been repeated in an "Historical Notice," professing to give "all the facts"—relates sketchily, confusedly, and often incorrectly what it does relate—contains much false theory and erroneous deduction—and boasts of no "better literary" style than is common to most academical exercises of the present day. We have already greatly exceeded the limits we had assigned to this notice; but as we should probably be blamed, were we to send forth so sweeping a sentence of condemnation without some proofs of our own gleaning in support of it, we shall trespass, for this purpose, a little further on the attention of the reader.

P. 8. "Hydrogen appears capable of uniting with oxygen in one proportion only, and water is the result of the composition. This fact may be proved by the following experiment:—Put a little alcohol in a tea-cup, set it on fire, and invert a large glass bell over it. In a short space of time aqueous vapour will be seen to condense on the inside of the bell, which by means of a dry sponge may be collected, and will be found to be pure water."

The position here laid down, and the experiment adduced to establish it, are both alike faulty. Water is *not* the only result of the union of hydrogen and oxygen, as the extraordinary powers of the oxy-hydrogen blow-pipe well attest; and though it is true that the two gases combine only in one fixed proportion, the collection of pure water from the evaporation of alcohol under an inverted glass bell, does not prove that or any thing of the kind.

P. 12. "One body is said to have a greater capacity for caloric than another, and the propriety of the term may be shown by the following experiment:—Dip a lock of wool and a piece of sponge in water, and observe how much more water the sponge is capable of taking up than the wool. Hence the sponge may be said to have a greater capacity for water than the wool."

Another most inconsequential experiment. It shows, certainly, that sponge has a greater capacity for *water* than wool; but what that has to do with the capacity of bodies for *caloric* we cannot understand.

P. 18. "The first person who, in modern times, applied it (the elasticity of steam) in a practical, though not in a powerful, manner, was Giovania Branca, who resided at Rome in the beginning of the seventeenth century," &c.

Not the "first person," assuredly. Mr. Alderson appears to be wholly ignorant of a fact, now tolerably well known to the scientific world, that, as early as 1543, Blasco de Garay actually propelled a ship, in the harbour of Carthagena, by means of an apparatus, "consisting of a large caldron or vessel of boiling water and a moveable wheel attached to each side of the ship." The reader will find the evidence on which this Spanish claim rests fully detailed in our 7th vol., p. 235.

P. 20. "This passage (No. 68 of the Marquis of Worcester's inventions) certainly contains a description of an engine for raising water by the repellent power of steam; and, from his expression of one vessel of water, converted into steam, forcing up forty vessels of water, *it is very probable that he had actually tried the experiment by a working model.*"

Mr. Alderson, then, is not aware that it is not merely "very probable," but now quite certain, that the Marquis of Worcester did actually exhibit to the public of his day a steam-engine applied to the raising of water. The "Diary of Cosmo, Grand Duke of Tuscany," published a few years ago, set this long-disputed point completely at rest.

P. 21. "The force of the steam-engine is derived from the property of water to expand itself in an amazing degree, when heated above the temperature at which it becomes changed into vapour or steam."

There is, of course, but *one* description of steam-engine to which this remark can apply, and that is the high-pressure; yet, immediately after (p. 22), the author tells us that high-pressure engines act on a *different* principle;" which assertion he proceeds to prove, by showing that they act on the *same* principle precisely.

P. 25. "We shall, therefore, pass on to Papin, who appears to have made a most important improvement in the generation of steam, if it be true what is very generally asserted, that he was *the inventor of the safety-valve.*"

Only seven pages before this Mr. Alderson himself, speaking of Branca, who flourished nearly a century before Papin, says—"The engine of Branca consists of a boiler *with a safety-valve*, to *prevent* accidents which might arise from explosion."

P. 55. "To condense by contact, and so use the condensed liquor over again"—"this no one has ever yet found it possible advantageously to effect."

A strange statement this to appear in a "Prize Essay" of the London Mechanics' Institution, where the method which Mr. Hall, of Basford, has so successfully introduced into practice, of condensing by contact, was first lectured upon, about a twelvemonth ago, to a London audience. Did Dr. Birkbeck and his pupils not believe their own eyes? Or are they yet ignorant that Mr. Hall's method is now in very general use in the steam-boats on the Mersey, and is fast-spreading, wherever economy of fuel and increase of speed are considered objects worthy of attain- ment?

P. 59. "Patents have been taken out for washing by steam, but as 'the *women fowk canna be fasht wi' it*,' the ingenious and well-meaning inventors are, we believe, seldom applied to for licenses, and certainly have no ground of complaint for infringement of patent-right."

Although washing by steam has met with but little encouragement in England, it has found favour enough in other countries, and is by much too useful an application of steam-power, to warrant the supercilious levity with which it is here noticed. In France there are upwards of two hundred establishments where clothes are washed by steam, in a

far better manner than by any process known to the "women fowk" of England, and at much less expense.

We might add largely to this catalogue of defects, but time as well as space now requires that we should lay down our pen. We regret that we have been obliged to speak so sharply of the production of a young aspirant for scientific distinction—for such we take Mr. Alderson to be; but when young aspirants forget the modesty that should attend a first endeavour, and the partial friends of young aspirants lose sight of truth and discretion in their praise, it should not surprise any one, that all personal considerations vanish, before the necessity which arises of convincing both parties, that neither presumption nor favouritism can be suffered to go—if unpunished—at least not unrebuked.

LIST OF NEW PATENTS, GRANTED BETWEEN THE 20TH OF MAY AND THE 24TH OF JUNE, 1834.

George Bather, of the Haymarket, scale-maker, for a weighing-machine upon a new construction. May 22; six months to specify.

Thomas Edmonds, of Burton-street, Hanover-square, for a certain process or method of manipulation and treatment for the preparation of leather, whereby it becomes less pervious to water, and preserves better its pliability during use than does leather prepared by the ordinary means. May 22; six months to specify.

Joseph Morgan, of Manchester, pewterer, for certain improvements in the apparatus used in the manufacture of mould-candles. May 22; six months to specify.

Charles Louis Stanislas Baron Heurteloup, of Holles-street, Cavendish-square, for improvements in certain parts of certain descriptions of fire-arms. May 22; six months to specify.

Andrew Smith, of Princes-street, Leicester-square, machinist and engineer, for a new and improved method of preparing phormium tenax, hemp, flax, and other fibrous substances, and rendering the same fit for hackling in the manufacture of linen, and for spinning in the manufacture of ropes, cordage, lines, and twines. May 24; six months to specify.

Luke Smith, of Manchester, cotton-manufacturer, and John Smith, of Hepwood, machine-maker, for certain improvements in weaving machinery. May 24; six months to specify.

Philip Augustus De Chapeaurouge, of Fenchurch-street, London, for a machine, engine, or apparatus for producing motive power, and called in France, by the inventor, "voland-moteur perpetuel," being a communication from a foreigner residing abroad. May 24; six months to specify.

Stephen Hawkins, of Milton House, near Portsmouth, for certain improvements in warming-pans or apparatus for warming beds and other purposes. May 24; six months to specify.

John George Bodmer, of Bolton-le-Moors, civil-engineer, for certain improvements in steam-engines and boilers, applicable both to fixed and locomotive engines. May 24; six months to specify.

John George Bodmer, of Bolton-le-Moors, civil-engineer, for certain improvements in the construction of grates, stoves, and furnaces, applicable to steam-engines, and many useful purposes. May 24; six months to specify.

William Crofts, of New Radford, in the county of Nottingham, for his invention of certain improvements in certain machinery for making lace, commonly called bobbin-net lace. May 27; six months to specify.

William Henry Hornby, of Blackheath, Lancaster, cotton spinner and merchant, and William Kenworthy, of Blackburn, aforesaid, engineer, for certain improvements in power-looms, to be used in the weaving of cotton, linen, silk, woollen, and other cloths. May 27; six months to specify.

Richard Simpson, of Southampton-row, Bloomsbury, for improvements in machinery for roving and slubbing cotton and wool, being a communication from a foreigner residing abroad. June 3; six months to specify.

John Bertie, of Basford, Nottingham, machinist, and James Gibbons, of Radford, machinist, for an improved texture of the lace-net, hitherto called bobbin-net or twist-net, and also certain improvements in lace-machinery, in order to produce lace-net with the said improved texture, either plain or ornamented. June 5; six months to specify.

George Saint Leger Grenfell, of Paris, merchant, at present residing at No. 4, Cadogan-place, Sloane-street, for certain improvements in the construction of saddles, being a communication from a foreigner residing abroad. June 5; six months to specify.

Edward Keele, of Titchfield, Southampton, brewer, for an improved valve and apparatus for close fermenting and cleansing porter, beer, ale, wine, spirits, and all other saccharine and fermentable fluids. June 7; six months to specify.

Thomas Ridgway Bridson, of Great Bolton, Bolton-le-Moors, bleacher, for certain improvements in machinery or apparatus to be used in the operation of drying cotton, linen, and other similar manufactured goods, being a communication from a foreigner residing abroad. June 10; six months to specify.

James Whitaker, of Wardle, near Rochdale, Lancaster, flannel-manufacturer, for certain improvements in engines used for carding wool. June 12; six months to specify.

Matthew Bush, of Dalmarnoch Printfield, near Bonhill, by Dunbarton, North Britain, calico-printer, for certain improvements in machinery or apparatus for drying and printing calicoes and other fabrics. June 14; six months to specify.

James Lee Hannah, of Brighton, M.D., for a certain improvement, or certain improvements, in surgical-instruments for reducing the stone in the bladder, and enabling the patient to pass it off through the urethra. June 16; six months to specify.

Joseph Jones, of Oldham, in the county of Lancaster, cotton-manufacturer, and Thomas Melledew, of the same place, mechanic, for certain improvements in the construction of power-looms, and in the manufacture of certain kinds of corded-fustian or fabric, to be woved in diagonal cords from cotton, wool, and other fibrous materials. June 16; six months to specify.

Charles Wilson, of Kelso, Roxburgh, for certain improvements applicable to the machinery used in the preparation for spinning wool and other fibrous substances. June 17; six months to specify.

Isaac Jecks, junior, of Bennett's-hill, London, for an apparatus or machine for pulling or drawing on or off boots. June 17; six months to specify.

William Symington, of Bromley, cooper, and Andrew Symington, of Falkland, in Fifeshire, watchmaker, for a paddle-wheel of a new and useful construction for the propulsion of vessels and other motive purposes. June 23; six months to specify.

John Chester Lyman, of Golden square, for certain improvements in hulling, cleansing, or polishing rice, in bearding or peeling barley, and hulling and cleaning coffee, being a communication from a foreigner residing abroad. June 24; six months to specify.

NOTES AND NOTICES.

Platina has been recently extracted, by a M. d'Angy, from a particular species of galena, found in the west of France.

Turkey Amber has been and is still used by many varnish-makers, as a drier. I, like many others, used it for years; but, from experience, I found it contained nothing of a particular drying quality, being only a mixture of clay, iron, vitriol, zinc, &c. I found it prevented every thing from settling into which it was introduced, for a length of time, and I, therefore, discontinued it. Its best quality is that of an absorbent.—*Mr. Wilson Neil.—Trans. Society of Arts.*

The Cochineal Harvest.—The insects are brushed off the branches, with a squirrel's or deer's tail, by women, who sit during this operation for whole hours at one nopal plant. Humboldt assures us, that, were it not for the extreme cheapness of labour, in Mexico and the Brazils, there would be no profit in rearing cochineal, though, when exported to Europe, it is almost as dear as gold.

From documents quoted in the "Morgenblatt," it appears that the celebrated Chinese wall was erected 213 years before the birth of Christ, against the Mongolese. It is 714 German miles long, 14 feet thick, and 26 feet high; so that, with the same materials, a wall, one foot in thickness, and 23 feet high, might be carried twice round the whole world.

Very Candid.—Dr. Jones, the Superintendent of the Patent-office at Washington, U. S., speaking of the expense attending the procuring of English patents for American inventions, in the last Number of the Franklin Journal, says,—"Were all inventions as good as their authors think them, this expense would be of comparatively little moment; but, in point of fact, there is not more than one in fifty of the patents obtained here which would be worth patenting in England, at so great a cost, although what is really new and useful will in general be better paid for there than with us."

Mr. Babbage has again started for Finsbury. We need not say how anxiously we desire to see science win the day. There is not a candidate opposed to him who would not gain ten times more honour by retiring in Mr. Babbage's favour, than he can possibly gain by being the means of his exclusion from a place in the councils of his country.

What has become of the remarkable system of Stenography stated, in the Mechanics' Magazine of May 19, 1833, to have been invented by a Mr. Thos. Scaife, schoolmaster, of Kendal, Westmoreland, and successfully reduced to practice (though on a limited scale) by that gentleman and one of his pupils? The inquirer has ever since been looking anxiously for the further development promised by the inventor.—J. L. *June* 21, 1834.

The Lord Chancellor and M. Dupin, the President of the French Chamber of Deputies, honoured by their presence, last week, the first of a series of lectures, delivered at the London Mechanics' Institution by Dr. Lardner, on Mr. Babbage's calculating machine. M. Dupin was presented on the occasion with the diploma of an honorary member of the Institution; and Lord Brougham made an address, in the course of which he announced the gratifying fact, that "great steps were now being taken for the promotion of the general education of the people," and added, that "it had been no fault of his *(as they all well knew!)* that similar measures had not been adopted long since." We conclude from this, that the Parliamentary reporters must have grossly misrepresented his Lordship a session or two ago, when they ascribed to him a very elaborate speech, from the woolsack, in which he demonstrated that a national establishment for the general education of the people is not at all necessary in this country!

Mr. Ward does wrong to consider our notice of his pamphlet on Mr. Snowden's Railway Scheme in the light of an "attack;" neither was it, as he supposes, by any means "hastily got up." We did not, certainly, follow the advice of his motto—"Before you doubt, examine"—but we examined because we doubted; and the result of that examination we have stated in plain, yet, we trust, sufficiently respectful terms. We must decline, therefore, entering again into the matter.

We are requested, by "An Old Subscriber," to announce that a new motive power has been discovered by a member of the Mechanics' Institution, which will "supersede completely the use of steam," being equally available under all circumstances, and "attended with much less both of expense and danger." We hope this may prove true, but we have our misgivings. The institution in Southampton-buildings has become, of late, rather a noted place for finding mares'-nests.

It is generally supposed that the many fatal explosions of steam-boats in America is owing to the use of high-pressure engines; but an American writer, quoted in the Franklin Journal, says,—"The truth is, our boats are on the *low*-pressure plan, but they carry from 16 to 25 inches of steam, which our boilers are not calculated to resist." There are few English boats worked at a higher pressure than 4 lbs.

Communications received from Mr. Baddeley—G. C.—A Soapboiler—J. L.—Bergein (with a parcel of specimens).

Errata in last Number.

P. 197, col. 1, line 21, for *quantities* read *qualities*.
—— — — 48, after *coal* add *tar*.
—— — 2, — 33, for '85' read '88.'
P. 198, — 1, — 17, for *vapours* read *vapour*.
—— — 2, — 45, for *make* read *mete*.

The Supplement to Vol. XX., with a Portrait of William Symington, is now ready, price 6d. also Vol. XX., complete, in boards, price 8s.

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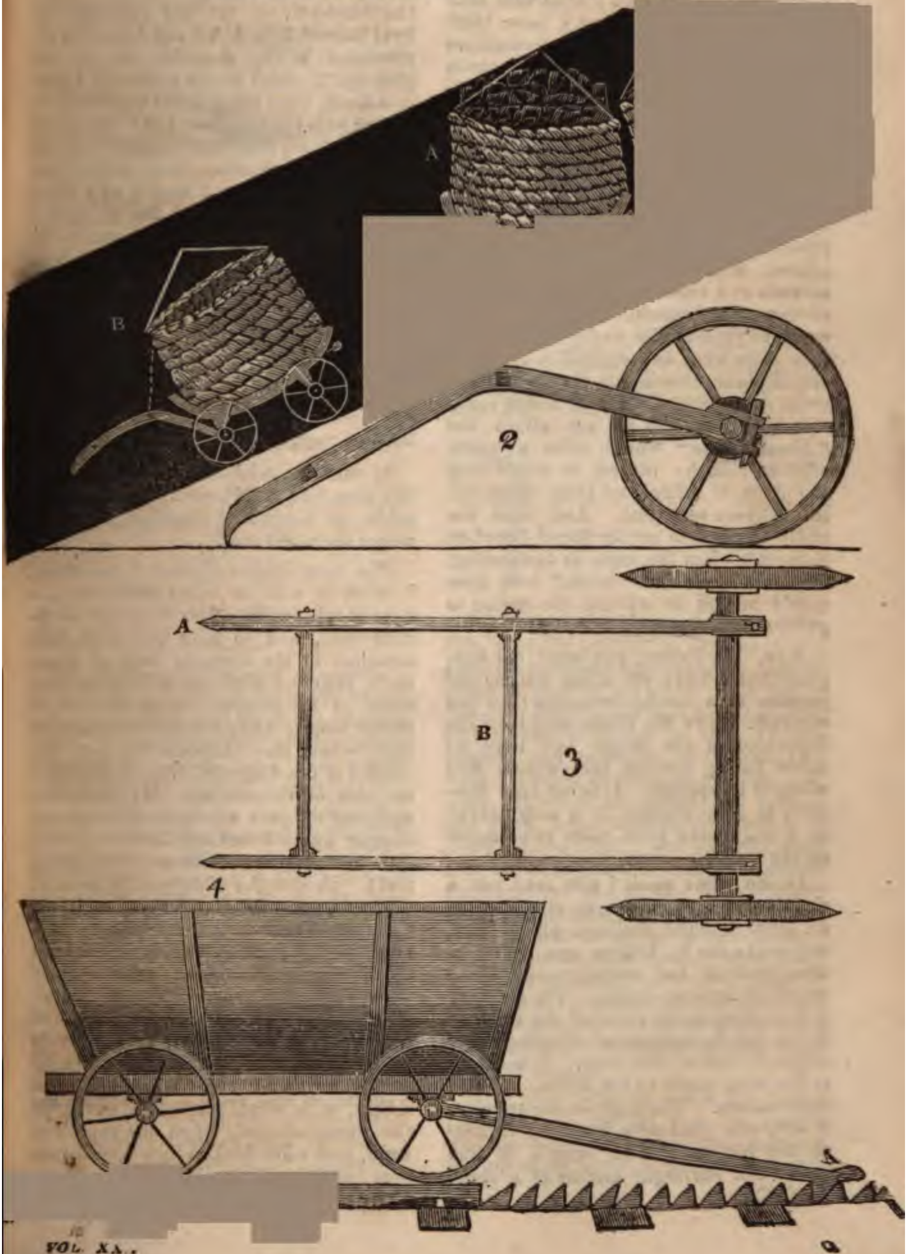
WEMYSS COLLIERY INCLINED PLANE.



MODE OF WORKING AN UNDER-GROUND INCLINED PLANE, AT WEMYSS COLLIERY, FIFESHIRE.

Sir,—The working of inclined planes is a subject with which I have had considerable experience, and I have tried various schemes to prevent the carriages running away when the rope or chain gives way: I have, therefore, read with much interest the account of the St. Helena inclined plane, and the method of stopping the "truck," and Mr. Deakin's judicious remarks about its inefficiency. I quite agree with him, that this contrivance does not merit the "handsome reward," as it is inapplicable to inclined planes, where more than one carriage ascends at a time. From the complexity of the affair it could not be applied to every waggon on the way. But suppose that there were one applied to every inclined plane, attached to the rope with a train of carriages after it, if any thing were to give way I am afraid the "blunt spikes" would make a pretty efficient plough: indeed, it would strip the plane, of rollers and every thing, unless it were *very flat*. And were the chain to run foul on the barrel (as often happens) when the train is descending, it would floor the "truck," and time would be lost in starting the engine to get it on its legs again.

Now, Mr. Editor, you must not suppose that I have set about finding objections to a useful invention: on the contrary, I give Mr. Hoare credit for the ingenuity of the thing, and have no doubt but it answers the purpose well where it is applied. It is but fair, however, to state wherein it is *only* useful, as it may draw forth more information on the subject.

In the same spirit I now send you a sketch of a stopper I have employed on an under-ground inclined plane here, not unlike the St. Helena one for steepness (nothing but necessity could make me adopt such an angle). The entrance to it is close to the shore of the Firth of Forth, for the purpose of winning a coal under the bed of that river. It is driven at the same angle as the strata, and is a little convex. The angle at the entrance is 20°, and gradually increases to 26½° at the bottom. The length is 320 *yards*. *Six carriages* ascend at a time. The whole weight of them, when loaded, is about 3¼ tons. The rails are of the tram form. The carriages are of malleable iron, the corfs of strong basket-work. The speed is 480 feet per minute. Upon the hind-axle of the last carriage two bent bars of iron A A hang loose (as represented in the elevation fig. 2, and plan fig. 3, which are on a scale of 1 inch to a foot), they are rivetted or bolted together with two stretchers B B. The points of the bars are sharp and steeled. When the train is ascending, these points trail along the ground, and should any thing give way the points enter the ground a little, and raise the last carriage to the roof, as shown at A, fig. 1, and deranges nothing; for the moment the chain is clasped the engine is started, and the raised carriage falls on the rail. When the train is descending (as shown in B, fig. 1,) the stopper is hooked up, and in that state travels to its destination below the river. There is a stopper for every train of waggons.

It must be admitted, however, that this plan, like Mr. Hoare's, is only applicable to particular situations, that is, where there is a roof.

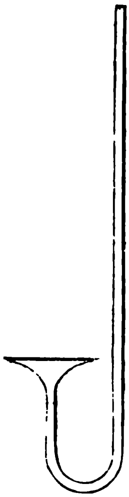
The next inclined plane I construct, I think it will be worth while to cast a rack-rail inside of each of the common rails, and to have two long palls attached to the foremost axle of every train, fastened together with stretchers, same as my stopper. They should be pretty long to bring the strain nearly on end, when they happen to get the weight of the waggons. Fig. 4 will give an idea of the scheme. My reason for applying it *before* will be obvious, as any stopper applied behind invariably upsets the waggons (where there is no roof). Should the disagreeable noise of the pall, travelling over the rack, be thought offensive, the rope can be fastened to the hook A, which would keep up the rope by its tension, until it gave way, when the pall would fall in and check their descent before they had time to acquire velocity; or advantage might be taken of Mr. Hoare's plan, by putting an axle across the two palls and checks, with small wheels to travel on the common road, when the rope was tight, and when broken they would turn over, and let the palls catch the teeth.

Trusting that these remarks may be of use to inclined-plane workers, and elicit more observations on this important subject,

I am, Sir,
D. LANDALE,
Mining Engineer,
Fifeshire, N. B.

Wemyss Colliery, May 12, 1834.

IMPROVED CHEMICAL FILTER.

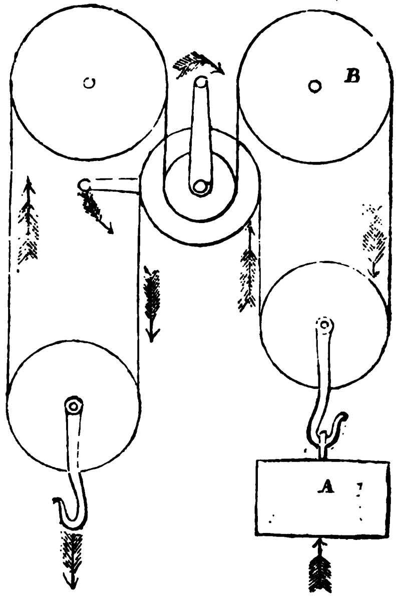


Sir,—The above sketch represents a plan of filter which has occurred to me, and appears likely to be of considerable service in some chemical manipulations. It is a long recurved tube, with a bell-mouth of very shallow curvature; over this the filtering paper may be tied, supported within and without by a fold of book muslin. Whenever the fluid has been made to pass over the arch and out of the orifice below, the filter will continue to act as a syphon, and will exert an accelerating pressure proportionate to the length of the larger leg. It presents, also, a great advantage from the manner in which it will draw the fluid out of a vessel *from above* the sediment, and not *through* it, as in common cases. By adding another tube, and adopting an exhausting syringe, it could be used as a forcing filter. I have the honour to be,

Mr. Editor,
Your obedient servant,

φ. μ.

COUNTER-CHECK TO THE VELOCITY OF DIFFERENTIAL PULLEYS — IMPROVED WINDOW-BLIND.



Sir,—It has not been remarked before, that the amount of friction is very great in a differential-crane, on account of the velocity of its parts. One way to diminish this velocity is to have the fixed and moveable pulleys as large as convenient, and to make the barrels that work the chain as small as possible. The shaft, on which the barrels and handles are fixed, must have large journals to stand the twist, &c.; and the great pressure on these journals, occasions most of the friction of the crane. The prefixed figure represents a plan of raising weights from a pit, in which there is every littl friction at these journals, because the pressure is taken off them by the weight A pulling the shaft up by the one barrel, and down by the other, while the small pin of the guide pulley B supports the weight.

Any one, who has read my former letter on this subject, can see how to arrange the guide pulleys, to produce a similar effect in the plan there described.

WINDOW-BLINDS.—To keep passers-by, and persons at a window opposite,

from seeing what is going on in your house, and at the same time to darken it as little as possible, you must have the blinds made so as to wind upon a roller, placed under the wooden sole of the window, as in the accompanying sketch.

If the friction is not sufficient to keep the blind at any height you want to have it, a small string, pressing upon either of the pulleys, will produce the desired effect. By having the blind to unhook at the ends of the cross-rod, light may be admitted at either one or both of its corners. A slit is to be left the whole length of the window-sole, for the blind to work through, and provision must also be made for taking out and putting in the roller. The fringe at the top of the blind may be drawn into the box at the window-sole, by giving the roller a turn or two, after the cross-rod is at the bottom, and then drawing the *string as much back*, to make the rod fill up the slit. To persons interested, other, and perhaps more suitable, fashions will present themselves.

I am yours truly,

JAMES WHITELAW.

Glasgow, May 16, 1834.

HEATONS' IMPROVED METALLIC PISTONS.

Sir,—I was greatly surprised at the communication of Mr. Barton, at p. 216 of your last Number. Had it merely contained the ordinary carpings of a narrow mind at the successful ingenuity of a rival, I should have permitted it to pass in silence. Mr. Barton has, however, made such groundless assertions, that I consider my own character for veracity at stake if I suffer them to go unnoticed.

Mr. Barton commences, by stating, that he has *no objection* to my *preference* of Heatons' metallic piston, which assertion is immediately contradicted by the whole tenor of his communication. Mr. Barton then complains that such preference is UNJUST. This, however, must be more logically proven before it can have any weight. Such an assertion is *unjust* on the part of Mr. Barton, seeing that all have an undoubted right to prefer what each believes to be best.

The most extraordinary part of Mr. Barton's letter, however, is where he denies that there is any improvement in Messrs. Heatons' contrivance; and yet, in the same breath, claims for himself all the merit of the same. For, says he, "*the very pistons, so highly lauded by your correspondent, were, in the first instance, made by me for Messrs. Heatons.*" *!!!*

Now, sir, this is wholly untrue. Whether it was "the numerous individuals, competent to judge upon the subject," that caused this gross misstatement "to be made extensively known through the medium of your highly respectable and valuable publication," of course I know not; but, if they did, I must advise Mr. Barton in future to seek more sagacious counsel.

I have been honoured with a letter from Messrs. Heaton, Brothers, on this subject, which I enclose for your insertion. In my description of Messrs. Heatons' piston (at page 134), I repre-

sented it as constructed with three segments; they are, however, usually made with four, but this in no way affects the beautiful principle of perfect equilibrium upon which they are constructed.

In conclusion, I have only to say, that I am most truly sorry that a man so rich in mechanical talent and renown, as Mr. John Barton, should display so much envious feeling towards an ingenious fellow-labourer in the walks of science or attempt to support his claim upon any other basis than that of truth.

I remain, Sir,
Yours respectfully,
W. BADDELEY.

July 1, 1834.

Copy of a Letter of Messrs. Heaton, Brothers, to Mr. Baddeley.

Sir,—We observe in the Mech. Mag. of Saturday last a letter of Mr. Barton's, in which he states that the improved piston you had occasion to allude to some time since, was made by him for the Messrs. Heaton. Now, sir, we positively state, that neither Mr. Barton, nor any other person, has ever made a metallic piston for us; nor have we ever seen in any of Mr. Barton's pistons an elastic ring for the springs to act upon, similar to the one of ours described by you.

We remain, Sir,
Your humble servants,
HEATON, BROTHERS.

Shadwell-street, June 30, 1834.

ON THE PHENOMENA OF FLAME—FURTHER OBSERVATIONS BY MR. J. O. N. RUTTER.

Dear Sir,—A few days after you had published my communication on the phenomena of flame (Mech. Mag. 564), one of your anonymous correspondents (F. A.) kindly transcribed for me the greater part of a paper on flame, published many years since by Mr. G. O. Sym, in the "Annals of Philosophy" (vol. viii. 1816, p. 321). About a week ago, another of your correspondents (Mr. Watson) very obligingly sent me the volume just mentioned, and also another volume of the same work (new series, vol. x. 1825, p. 447), containing a paper on the same subject, by Mr. J. Davies. Thus have I, very unexpectedly, had an opportunity of seeing, for the first time, what has been done by the gentlemen so honourably mentioned by Dr. Thompson, in this *interesting department* of experimental science. Far from being discouraged at perceiving that a portion of the ground I have lately travelled over is pre-occupied, I rejoice to find that some of the results of my own independent and unassisted experiments are verified and supported, by a reference to such respectable authorities. It may justly excite our regret that so little appears to be known of these papers. Mr. Sym, who is long since gone to the grave, satisfactorily proved that flame is hollow. Mr. Davies advanced still farther, and demonstrated not only that the interior of flame will not support combustion, but that it contains no oxygen.

To clear the soil of weeds is an employment equally necessary, although it may not be so honourable nor so satisfactory as that of casting abroad the precious seed on which depends the future harvest. The uprooting of error aids the development of truth in all its fair proportions. Important principles often lie concealed beneath an incrustation of absurd theories, the prejudices of antiquated habits of thought and expression, or the deformities with which vague speculation invests some of the most simple and the most beautiful ordinations of nature.

Should it hereafter appear that I have assisted in clearing some of the difficulties out of the way of only one sincere inquirer after truth—thus facilitating his progress towards just conclusions respecting the nature of flame, I shall feel that I have obtained an adequate reward.

In the process of combustion, "gas" and "vapour" is a necessary distinction. As I have never seen this insisted upon by any writer in any way that indicated an accurate conception of its importance, I hope I may be permitted to add a few "last words" in further elucidation of my views.*

It would, I suppose, be hazardous to deny that every solid and liquid body may be made to assume the gaseous (vaporous?) form, and that every gaseous (vaporous?) body may be reduced to a solid or a liquid. The terms *gas* and *vapour*, as ordinarily employed by us, do not possess a very determinate significa-

* See Mech. Mag. 564, pp. 145, 146, § 43, 44, 45, 47.

[illegible] The bodies we denominate gaseous, [illegible] permanent [illegible] certain [illegible] temperature and pressure, [illegible] more [illegible] liquid [illegible] divided [illegible] with caloric. [illegible] sufficiently [illegible]

show that the terms *gas* and *vapour*, in their popular sense, are arbitrary distinctions; and that they do not determine, with philosophical accuracy, the precise nature of the bodies to which they respectively refer—vapour being, probably, the most correct definition of the elementary division of bodies when combined with caloric in the aeriform state, or during their transition in forming new compounds in the solid or liquid state. Dear Sir,

I am very faithfully yours,

J. O. N. RUTTER.

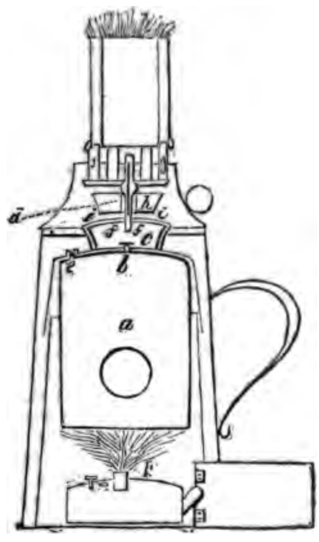
Lymington, June 25, 1834.

THE REFRACTIVE POWERS OF THE ATMOSPHERE, A FREQUENT SOURCE OF ERROR IN SURVEYING.

Institution of Civil Engineers, April 15.—A conversation was held on the refractive quality of the atmosphere as affecting the taking of levels—an extract from the Memoir of the late Captain Joseph Huddart, relating to the subject, having been previously read. Captain Huddart had frequently remarked that low lands, and the extremities of head lands forming an acute angle with the horizon when viewed at a distance, appeared elevated above the horizon with an open space between the land and the sea. These appearances he considered to arise from, and be in proportion to, the evaporation going on at the time, and felt convinced they were caused by evaporation; and that, instead of the refraction of the atmosphere increasing to the surface of the sea, it must decrease towards it from some elevated space; and that the principal cause which prevents the uniformity of density and refraction being continued, by the general law, down to the surface, is evaporation. He also conjectured that the difference of specific gravity in the particles of the atmosphere, may be a principal agent in evaporation; for the corpuscles of air, from their affinity with water, being combined at the surface of the fluid with expansion, form air specifically lighter than the drier atmosphere, and therefore rise, and become lighter as they ascend, until they become of the same density as the atmosphere. A member concluded, from the above statements, that the maximum of refraction was at the point most elevated from the surface to which evaporation extends, and consequently that a person

should be guarded in taking levels when elevated from the surface of a marsh or body of water during the process of evaporation.—A member had frequently observed objects across the Thames come into view on the rise of the tide which at low water were hidden by the intervening land, this he attributed entirely to refraction, and considered that levels across a body of water should be taken as near the surface as possible. It was observed that this phenomenon was probably caused by the greater width of refractive medium; also, that long sights were to be avoided in taking levels after heavy rains; and that in levelling across a stream more accuracy would be attained by assuming the height of water equal at both sides, than by taking a sight with a spirit level."—*Athenæum.*

MOREY'S VAPOUR LAMP.



The Franklin Journal for May last contains the specification of a patent granted, in the United States, to Mr. Samuel Morey (a name already well known to the British public, in connexion with steam-engine speculations), for a lamp or apparatus for producing artificial light, constructed on a principle similar to that of Mr. Rutter's patent method of producing heat. We have no doubt this will *prove a very* valuable invention, and as we understand there is an attempt making by certain parties (not Mr. Morey) to patent it also in this country, we hasten to publish the whole particulars, that all who please may make lamps for themselves, on this plan, without leave or license from the intended forestallers.

Mr. Morey's Specification.

This improvement consists of a metallic cylinder of such dimensions as may be desired, strong enough to bear a pressure of three or four pounds to the inch. In the centre of the top of this cylinder, there is to be a small tube inserted, about half an inch long, with a single hole in the upper end, of about from one-twentieth to one-sixtieth of an inch diameter. Round this small tube with a single hole, there is to be another tube an inch or more in diameter, and about an inch long, soldered to the top of the cylinder, having a cap that may be screwed on, or taken off; in the centre of which cap a screw may be fastened about one-eighth of an inch or more diameter. Around this screw, and in a circle, holes are to be made, about one-fiftieth or one-sixtieth of an inch diameter, and about one-third of an inch apart. A conical tube, about three inches long, and about three-fourths or more of an inch diameter, at the lower end, having a bar across near the bottom, with a hole and screw in the centre to fit that in the lower end of the conical tube. In the top of the cylinder a safety valve is to be affixed. It is then ready for use. To use it, put into the cylinder, through the safety valve, half a gill, or more, of spirits of turpentine, and about the same of water. Apply heat to the cylinder until the vapour issues pretty freely through the conical tube on the top. If a flame is applied to that vapour, it takes fire, and burns with a beautiful white flame, like a gas-light. If there is any smoke, turn the conical tube on the top to the left, which will admit more air at the bottom to be mixed with the vapour in its ascent up the tube. As the vapour issues through the small holes in the cap, into and through the conical tube, by the pressure in the boiler, it will mix with, and carry along through the tube, in passing along, more or less air, in proportion to its velocity, by which means it is easy to make these lamps burn with all degrees of intensity, from that of a white flame and smoke, to that of a very intense white, to blue and white, and to that of all blue, and from that to perpetual explosion. These cylinders, which may be made to hold half a pint, or many gallons, it will be well to enclose in such a manner as to preserve

the heat; thin plates of tin answer well, and it will require that they be as much longer than the cylinder as will allow of a standing on the bottom under the cylinder, when desired to heat it with oil, or alcohol. It seems immaterial how or in what method the heat is applied, so that it is steady, and can be readily lessened or increased. To light-houses, or wherever a large flame is required, most likely nothing will be better, or cheaper, than anthracite coal, unless the heat is applied from the same stove, or lamp, after once in operation. The flame of a lamp of alcohol, not much, if any, larger than that of a common candle, will cause vapour enough to rise or issue, to give the light of ten or fifteen candles, and heat enough to boil a two quart tea-kettle in seven or eight minutes. When the vapour issues freely and rapidly out of the conical tube, and is inflamed, it is plain to see the effect at least of the rapid decomposition of water. The flame will be a light blue for some inches above the tube, and on the outer edge of it there will, apparently, be a border, which has the appearance of decreasing rapidly towards the outer edge, and becomes entirely invisible in about one-eighth of an inch. The heat increases as the flame becomes less and less visible, and this is continued not only to where there is no appearance of any flame, but to a sensible distance beyond; where the heat is more intense than any where within the visible flame; which is made apparent by holding a fine wire across the flame. There does not appear to be any smell of turpentine from these lamps, unless the vapour is allowed to escape without being inflamed. Alcohol and spirits of turpentine may be made to burn in the same for many uses, particularly for lighting and warming rooms; but when alcohol is burned, it will require only about one-fifth or one-sixth of spirits of turpentine to give it the white flame; or alcohol may be mixed with water in any proportion, but the greater the proportion of water the more spirits of turpentine will be required. In the latter part of my experiments, I have generally made the covering in the form of a common tin-plate coffee-pot, as much larger that the cylinder as would allow of setting in a lamp on the bottom, through an opening on one side. The use and object of the box on the upper end of the cylinder, is to answer, in a great measure, the purpose of a gasometer in gas-works. It allows of working with much pressure in the boiler, thereby giving a much steadier issue of vapour. And as it passes into the box with a number of holes, the issue from those holes is easily adjusted, so as to have it mix with a due proportion of atmospheric air before it is inflamed, and with a velocity that will ensure its further supply, sufficient to ensure a most perfect combustion; giving to this mode great and decided advantages over all others in burning the vapours of the liquors before mentioned, as well as all others that can be conveniently evaporated, and that are combustible; and I can see no reason why carburetted hydrogen gas may not, in this way, be burnt ithw a large volume of flame, without any smoke, which will in many cases be very useful. The great and surprising volume and quantity of light and heat given out by these lamps and stoves, appears to me, evidently, to arise from the perpetual decomposition of the water in the combustion, and its recomposition from the air within the flame, as well as that surrounding it; which is owing, in a great measure to the vapours of the liquors which contain much carbon as well as hydrogen, being so intimately mixed and blended with a great supply of atmospheric air, both before it is inflamed and after, and that constantly. These lamps have this great advantage, that the same lamp can be made to burn regularly with the light of one or two candles, or twenty, or thirty, or more. Nothing can be more convenient than these lamps are for cooking, to a certain extent; with a half gill of spirits of turpentine, as much water, and one-eighth of a gill of alcohol, two, or more, two-quart tea-kettles can be made to boil in less than five minutes each, and bread toasted and meat enough for three or four men may be boiled. In boiling meat, it will be necessary to turn the tube off laterally, a few inches, and to have the flame blue or nearly so. So again, nothing, I should think, could be more convenient for soldering than these lamps; for the moment you bring a piece of thin sheet copper in contact with the blue flame, having a piece of silver solder, or common silver and borax on it, the solder is instantly melted, and the copper very soon. So also small brass wire brought over the flame instantly drops to pieces; and small copper wire is as soon melted, and very fine iron wire, when the mixture of air and vapour is in the best proportion, is instantly inflamed.

What I claim as my invention, and for which I ask a patent, is an improvement upon the mode of producing artificial light and heat for illumination, or other purposes, by mixing together, in suitable proportions, water, alcohol, or water and alcohol with spirits of turpentine, in a cylindrical, or other shaped, vessel, and inflaming the vapour extricated by heating the said mixture —which improvement consists principally in causing the vapour of the liquors to issue through holes from the evaporator into a small box, or reservoir, and from that

reservoir, through such a number small holes, into and through a or other shaped tube, with such l velocity as will ensure its mixture nuch atmospheric air, as will, when , induce a perfect combustion,—the s of which improvement are herein-escribed. And I do hereby declare, not intend to confine myself to any m or proportions in the apparatus employ, but to vary the same as desired, in any manner which admits perating upon the same principle, which a similar effect is produced.

SAMUEL MOREY.

Description of the Engraving.

a metallic cylinder; *b*, a small tube eth inch diameter; *c*, another tube diameter; *d*, screw; *e*, safety-valve; . apertures through which vapour the tubes; *g*, tubes; *h*, conical tube er; *i*, place for the admission of atic air; *k*, heat for generating vapour.

Remarks by Dr. Jones.

tatements of Mr. Morey may be reost implicitly, in whatever relates to ts which have come under his own ion; and he has been an indefati-perimenter and observer, more es-as regards the production of flame ombined action of alcohol, essential water. In an article published in 's Journal, vol. xxv. p. 150, he says, no doubt that I have tried lamps, and machines, in more than four l different forms, for effecting these ; and yet not many months have since I have felt entirely satisfied.

experiments which I have made, ved practically, that an engine with equal to driving a boat four miles and a rail-road car twice that dis-the same time, with ten or twelve rs, may be made for one hundred and that the engine with its prepar-l (a substitute for the boiler in the gine) need not weigh one hundred and the expense of working it will ed ten or twelve cents per hour. e certainly no difficulties to be re-These facts have been verified prac-and repeatedly before hundreds of

e recent improvements in the mode ucting lamps for burning water to light and heat, have perfected the for these purposes. It now carries ation in every form."

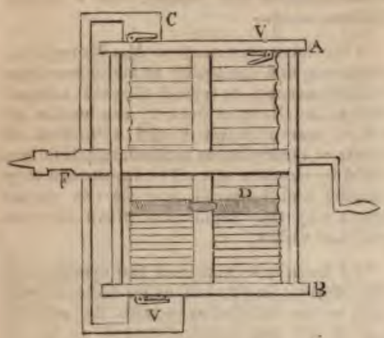
The foregoing observations are succeeded by some account of the effects produced by the flame, similar to those noticed in the specification of his patent; and Professor Silliman adds—

"We have seen some of Mr. Morey's experiments, and can testify to the correctness of his statements, as regards the great amount of heat and light evolved by combustion of the vapour of water mixed with that of spirits of turpentine or alcohol, and duly modified by common air. The results are very striking and beautiful, and we can see no reason why they should not prove of great practical utility."

We have not witnessed the operation of Mr. Morey's lamp, but as we have already said, we are satisfied as regards the correctness of his statements, although we by no means agree with the gentleman in his theoretical views. In the article to which we have alluded, Mr. M. has given these at some length, but in doing so he has assumed as settled certain points with respect to the nature of electricity, which are by no means generally admitted by philosophers; and upon these he has founded his theory, or rather his hypothesis. We, however, should deem it out of place here, to enter into an argument on this subject; so far as the lamp and the patent are concerned, the question is one of facts, and it will afford us much more gratification to find that this invention is publicly introduced, generally approved, and fully compensating the author of it for his indefatigable and meritorious exertions, than we should be to establish our own theory, if we have one, of its *modus operandi.*

We will, however, make a remark or two, with respect to one point in the theory, that is, on the "burning of water." The idea of doing this is not peculiar to Mr. Morey, as others have taken patents for "water-burners;" and certainly the introduction of the vapour of water among burning fuel has, under many circumstances, the effect of quickening the combustion, and, more especially, of enlarging the flame; still we do not believe, in spite of this sensible evidence, that these effects are produced by the decomposition and recomposition of the water, but think that they arise from its mechanical action in diffusing the material of flame so as to expose it to a larger portion of atmospheric air. We have before made the remark, and will here repeat it, that so far as the production of light and heat are concerned, it would seem to us that the simultaneous decomposition and recomposition of water must neutralise each other.

HYDRAULIC BLOW-PIPE.



Sir,—In your Journal of the 1st Feb. last, there is a plan of a hydraulic blow-pipe; this, and an abortive attempt, in which I lately spent some hours to no purpose, in working with an inefficient blow-pipe, set me a thinking, and the following plan is the result. I think it will be considered to combine simplicity of construction and efficiency nearly as much as may be.

A and B are two circular pieces of wood, firmly connected by four pillars of wood, three of which are seen. A cylindrical air-tight bag is fixed between A and B, and is divided into two equal parts by a solid diaphragm of lead, seen under the letter D. This diaphragm has two rings at diametric points, which run on two of the pillars and steady the weight; one of them is seen. A and B have, each of them, an air valve opening inwards; one of them is seen at V, as if through the bag. They have also each a valve opening outwards, into the boxes C and C′. From each of these boxes there proceeds a pipe down to F, a circular box into which the pipes open. F is a sort of pipe, wide where it receives the tubes coming from C C′, and immediately after contracted, so as to be capable of serving as an axis on which the whole apparatus may turn. It ends in a nozzle, made so that blow-pipe jets of different sizes may screw into it. Diametrically opposite is another axis with a handle, and from one axis to the other there passes a circular hoop, which is fastened to the adjacent two pillars, but passes outside of the other two; this is for strength's sake. Two uprights (not in the figure) support the axis, and the apparatus is complete, if only you add a catch which may engage the handle at each vertical position, and retain it there until the next turn. Care must be taken that the perforation of the jet used is truly in the centre of the axis, and the lead diaphragm should be of a weight equivalent to the pressure usually required; if greater pressure is requisite, weights can be added to the rings, which may be contrived with conveniences for such an addition; if less pressure be necessary, you have only to fix the machine at an angle proportionably deviating from the perpendicular, and the pressure will be in the same degree lessened. By introducing an air-tight joint at F, and adding a small fixed air reservoir, it would be easy to prevent any intermission in the blast. This contrivance might perhaps be available on a larger scale, and for more important purposes.

I am, Sir, yours, &c.

φ. μ.

MODE OF PURIFYING PALM OIL.

To purify Palm Oil, and to whiten it comparatively for making Soap.—Take two parts of quick lime and three parts of the muriate of ammonia, the lime having been previously slacked with half its weight of water, and allowed to cool and reduced to a fine powder, and the muriate of ammonia having also been reduced to a fine powder, and then intimately blended with the powdered lime. The mixture is to be put into a still, or cast-iron pan, having a close cover to it, and a tube leading from the head of the pan or still to near the bottom of the soap copper, which should contain equal quantities of water and palm oil. On fire being applied to the still, the ammoniacal gas will pass over into the soap-copper; and as the water and oil combine, continue adding boiling-water to the extent of treble the weight of palm oil in all. By this process the colour of the palm oil will be almost instantaneously changed to a pale yellow. The boiling palm oil and water should, of course, be kept rapidly stirring while the gas is passing through. The ammonia being an alkali adds to the strength and detergency of the soap, while the peculiar smell imparted by it is so weak as scarcely to be susceptible after a few days' exposure to the atmosphere.

S.

Fig. 1.

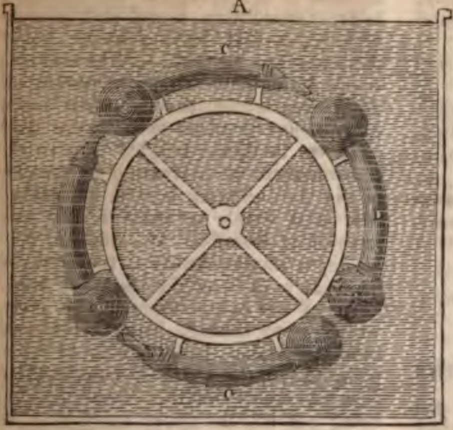


Fig. 2.

TWO "CERTAIN" PLANS FOR PRODUCING PERPETUAL MOTION.

Sir,—Very few young mechanicians escape being seduced into an attempt to produce a perpetual movement, by making gravitation counteract itself. They are not contented with being told by older men, that a curve can never be made to exceed its own power; yet gravitation is expected by them to lift up on one side more weight than sinks on the other, with some per centage of friction into the bargain. Nature, however, is too true to itself to be so taken in, by all or any of the multitudes of various ways the inventive genius of man has contrived, and still keeps contriving, to circumvent her immutable laws, with no other effect than to render the case so complicated as to puzzle the judgment of the inventors, which ends usually in their firm belief, that they have outwitted nature instead of themselves. I acknowledge that in my youth I was one of this class, and, for the benefit of the young fry, I beg to present you with two *certain* plans for producing perpetual motion, and compelling *gravity* to be *frolicsome*, and do more work than she ought.

Let A, fig. 1, be a cistern full of oil or water, above 4 feet deep. Let B be a wheel, freely suspended within it on its axle. Let there be four wide glass tubes, 40 inches long, *c c c c*, having large bulbs, holding say a pint, blown at the closed end. Fill these tubes with *mercury, fix on an* Indian-rubber ball or bladder, that will hold a pint, to each of them at the open end, and let them be attached round the wheel, as exhibited in the figure. As the pressure of 40 inches of mercury will exceed the atmospheric pressure, and also that of the 4 feet column of water, when the Indian-rubber bottle is lowest, and the tube erect, as at D, the mercury will fill it, leaving a vacuum in the glass bulb above. On the opposite side the mercury will fill the glass bulb, and the Indian-rubber bottle will be pressed flat, as will also be the case in the two horizontal tubes. Now it is evident that the two horizontal tubes exactly balance each other; but the tube D, *with its bulb swelled out*, displaces a pint of water more than its opposite tube, and hence will attempt to rise with the force of about 1 lb.; and as each tube, when it arrives at the same position, must produce the same result, the wheel must have a continual power equal to about 1 lb., with a radius of 2 feet.—Q.E.D.!!!

Let fig. 2 represent a light drum of wood, one half of which is inserted into a cleft in a water-cistern A, which fits it, and from which the water is prevented from escaping by a strip of leather, which the water presses against the drum, and which thus operates as a valve, without much friction (especially if oil be substituted for water in the cistern). Now, as this drum is much

lighter than water, it must ever attempt to swim, and thus, in perpetually rising, cause the drum to revolve forcibly round its axle.—Q. E. D.

I tried this last method thirty years ago, but it was *so obstinate* as not to move one inch at my bidding, though it obviously is proved, to demonstration, that it ought to have gone on swimmingly. I have just heard that an Italian gentleman has hit upon the same plan; so it seems that the mania is not confined to England.

Yours truly,

G. C.

Brompton.

ANOTHER EQUALLY "CERTAIN" SCHEME OF PERPETUAL MOTION.

Sir,—As I have observed that few things so effectually stimulate the exercise of the mechanical ingenuity of your readers, as the suggestion of any new mode of obtaining the perpetual motion, I crave insertion for the following scheme for that purpose:—

Let a cylinder be prepared, say 13 inches in diameter, and 30 feet in height. This cylinder may be filled with any fluid substance—take, for instance, mercury. At about 1 foot from the bottom a valve is to be fixed horizontally across the cylinder, and beneath this a lateral opening, closed with a tight fitting door is to be made; or, instead of this, a second valve may be made at the bottom of the cylinder. If a cylindrical mass of iron or lead, for example, be now introduced, either by the lateral or end opening, and the valve or door closed, and then the upper valve be lifted up, the mass of iron or lead, being of less specific gravity than the mercury, will ascend to the top of the cylinder, and raise also such additional weight as may be required to balance the difference of gravity; and when it arrives at the surface of the mercury, the mass being made to descend on the outside of the cylinder, will, of course, give a power equal to its weight, falling through 30 feet in air.

If the machine proposed consisted of no other parts than those described it would be evidently useless, because, whenever the lower valve was opened, *the quantity of mercury* or other fluid, *below the upper valve*, would escape; and when the upper valve was opened, to allow of the passage of the ascending body, the column would sink proportionally, so that, leaving friction out of the question, all that could be obtained would be a mere balance of power, all the power which the machine could exert being required to raise the fluid again to its former height. But two or three methods of preventing the sinking of the fluid column may be suggested. The most simple of these I will now proceed to describe. If a cistern, containing a small quantity of the fluid, be fixed at a little height above the upper valve of the cylinder—upon the body, which is to ascend, being introduced into its chamber, and the door or valve being closed, the chamber may be filled from this cistern, and the communication being cut off, the upper valve may be opened, and the ascending motion put into action. From the difference of specific gravity, sufficient power would be obtained in the ascent to pump up the fluid again into the cistern; and thus we should not only have the perpetual motion, but considerable available power to boot, namely, that arising from the descent of the body outside the cylinder.

I am, Sir,
Your obedient servant,

A SEEKER.

May 15, 1834.

LARDNER'S ARITHMETIC.

Dr. Lardner has just contributed to his own "Cyclopædia" a volume on the science of Numbers,* which takes far higher ground than the common school treatises on the subject. The learned Doctor, while he gives, like them, the plain and practical rule for working each of the various problems, aims also at the more important object of explaining the reasons of the process, and leading the student's mind to the perception of the "why and because" of every operation he performs. It must certainly be conceded that arithmetic, as usually taught, is a mere empirical science, of the theory of which the learner (and very often the teacher) knows just as much as a blind horse in a mill of the theory of the wheel-

* A Treatise on Arithmetic, Theoretical and Practical, by the Rev. Dionysius Lardner, LL. D., F.R.S. London; 1834. Longman and Co. Small 8vo., pp. 353.

he puts in motion. Yet neverthe- it will admit of question whether, class-book, Dr. Lardner's treatise be of more utility than the "Tu- Assistants," which regularly pursue old beaten track—whether it would ore advantageous to delay the stu- at every step of his progress, that he t see how he had taken it, or to let run as fast as possible to the end of ourney, and then pause and take a y of the whole at once. The worst is, that this survey, when all is , is very seldom taken.

. Lardner commences his labour a chapter on "Ideas of Number, heir expression by words," in which y considerable number of highly- esting facts are brought together, ng chiefly to the methods of nota- n use among the various nations of orld, both civilized and savage, in nt and modern times, and to the s of the numerals in their various ages. For most of these Dr. Lard- onfesses himself indebted to the ar- on arithmetic, by Mr. Peacock, of ridge, in the "Encyclopædia Me- litana;" an article at once so learned, ll and so complete, that it may be o exhaust the subject. The same e has also supplied most of the ma- s in the succeeding chapter on the thod of expressing numbers by sym- or figures." This includes a sketch origin of the Arabic notation, and troduction into Europe, from which tract the following:—

ll Arabian authors on arithmetic ap- to agree that the first writer of that y upon this system of arithmetic was mmed ben Muza, the Khuwarezmite, flourished about the year 900. This is celebrated for having introduced his countrymen many important of the science of the Hindoos, to the ation of which he was devotedly at- ; and, among other branches of know- thence derived, there is satisfactory ce that this system of arithmetic was From the time of Mohammed ben , the figures and modes of calculation uced by him were generally adopted by fic writers of Arabia, although a much period elapsed before they got into n popular use even in that country. were always distinguished by the *Hindasi*, meaning the Indian mode of *tation. Alkindi, the* celebrated Ara- *iter, who flourished* soon after Ben Muza, wrote a work on arithmetic, entitled "Hisabu l'Hindi;" meaning the arithmetic of the Hindoos. In addition to this evidence of its Indian origin, we have the unvarying testimony of all subsequent Arabian writers. But there is internal evidence from the system itself, as compared with the mode of writing and reading Arabic, which furnishes a still more decisive proof of its origin. The mode of writing practised in Arabia was like ours, from left to right; where, as in writing those figures, they proceed in the contrary direction, in the manner practised by the Hindoos."—p. 35.

Now that we are so well acquainted with the immense superiority of this system, it seems strange that it should have been so long in making its way into general use, as our next extract will show it to have been. Our surprise, however, may well be abated, when we reflect on the magnitude of the change, and consider how many obstacles must have been offered to the progress of such an improvement, in the dark times of the middle ages:—

"Notwithstanding the knowledge and practice of this superior notation by scientific men, the Roman numerals continued to be used for purposes of business and commerce for nearly three centuries; and it was only by slow and gradual steps that the improved notation prevailed over its clumsy and incommodious predecessor. The first attempt to introduce it, for the purposes of commerce, was made by a Tuscan merchant, Leonardo Pisano, who, in 1202, published a "Treatise on Arithmetic," with a view to introduce it among his countrymen. Leonardo had travelled into Egypt, Barbary, and Syria: his father appears to have held some office in the custom-house at Bugia, in Barbary, where he represented the interests of the merchants of Pisa. The son there learned the method of Hindoo arithmetic; and, struck with its superiority over that to which he had been accustomed, he determined that his countrymen should no longer be deprived of the benefit of it. He accordingly published his treatise in the Latin language, in which he professes to deliver a complete doctrine of the numbers of the Indians. 'Plenam numerorum doctrinam edidi Hindorum, quem modum in ipsa scientia præstantiorem elegi.'

"The date of this work has been disputed, and it has been contended that it is the production of a later age. This supposition is, however, attended with some difficulties. * * * * The work of Leonardo is referred to by Lucas de Burgo, in 1484, and by all subsequent writers, as being the first

means of introducing the Arabic notation into Italy. A considerable period, however, was necessary, to introduce this system into the common business of life. The extensive commerce maintained by the Italian states, directed their attention to the subject at an earlier period than other nations; and although, for scientific purposes, the date of the introduction of the Arabic numeration into Spain is earlier than that of its appearance in Italy, yet its use for the common business of life prevailed at a much earlier period among the Italian states, than in any other nation of Europe. To the exigencies of Italian trade we owe the formal subdivision of arithmetic, under the various heads of the rule of three, profit and loss, exchange, interest, discount, &c. &c."—p. 38.

Dr. Lardner's favourite method of explaining the reasons of the arithmetical processes, is by the use of (imaginary) counters in lieu of figures. By this means he illustrates many of his positions happily enough, although we cannot help thinking he goes too far when he asserts, *without qualification*, that by such means the "very possibility of error" is avoided. Error is unavoidable, whether single counters or figures representing a number of units are employed: there is only a difference as to the probability of its occurrence, however vast that difference may be.

An extract from the Doctor's fourth book, in which, after having in his previous divisions disposed of the addition, subtraction, multiplication, and division of (1) whole numbers (2), fractions and decimals, and (3) complex numbers, he proceeds to treat of "proportion," will suffice to convey some idea of his style of elucidating the mysteries of arithmetic:—

"THE DIRECT RULE OF THREE.—*Example I.—If 25 bales of goods cost 650l., what will be the price of 384 bales of the same goods?*

"ANALYSIS.—In this question the price is supposed to increase or decrease in the same proportion as the number of bales increases or decreases. Now there are two numbers of bales proposed, the price of one number being given, while the price of the other number is sought. It is clear that whatever the sought price be the given price must have the same proportion to it as the number of bales to be obtained for the given price has to the number of bales obtained for the sought price; that is, 25 bales will be to 384 bales in the same proportion as 650l. is to the price of 384 bales. Let us suppose that this unknown price of 384 bales is expressed by the letter x: a proportion must exist between 25, 384, 650, and x.

"COMPILATION.—We have then—

$$25 : 384 = 650 : x.$$

We find x the fourth term of the proportion, by multiplying together the second and third, $384 \times 650 = 249600$, and dividing the product by the first (378). The price, therefore, of 384 bales is,

$$25)249600$$

$$\overline{\pounds 9{,}984}$$

"If the student should find any difficulty in comprehending the reasoning on which this process rests, it will be made still more evident by proceeding in the following manner: First, find the price of a single bale. This is easily done; the price of 25 bales is 650l., and the price of a single bale must therefore be the twenty-fifth part of this. If we divide 650 by 25, we find the quotient to be 26; the price of a single bale is therefore 26l. To find the price of 384 bales, we must multiply the price of a single bale by 384. The product of 26 and 384 is 9984: the price of 384 bales is therefore 9,984l.

"It will easily appear that these two processes are in fact identical. In the first we multiply the third term of the proportion by the second, and divide the product by the first. According to the second method, we divide the third by the first, and multiply the quotient by the second. The same operations are therefore performed in each case, but are performed in a different order."—p. 296.

In conclusion, we must observe that we are rather surprised the Doctor should have omitted a description of his friend Mr. Babbage's calculating machine, on which he has recently been lecturing so much to the satisfaction of the Lord Chancellor and *other members* of the London Mechanics' Institution. It would certainly have afforded some very apposite illustrations of many of the positions in the earlier chapters of his book, while it would, at the same time, have gratified the curiosity, and excited the interest of a great number of his readers, in no ordinary degree.

STEERING STEAM-VESSELS FROM THE BOW.

In our journal (No. 417), for 6th Aug., 1831, we inserted a paper by Captain

Basil Hall, in which he described the method of steering steam-vessels from the bow, generally followed in America, and strongly advocated its adoption in this country. We afterwards inserted (No. 428, 22d Oct. 1831,) a plan for the same purpose, suggested by our intelligent and indefatigable correspondent, Mr. Baddeley, which though not so simple as the American one, seemed to him as it did to us, to be in several respects superior, more particularly in offering a greater command over the rudder, with less labour to the helmsman. Neither of these proposals was, however, we regret to say, attended with any practical result. More recently the attention of the public was recalled to the subject, by a letter from Nathaniel Gould, Esq., the chairman to the North American Colonial Association, which appeared in the *Nautical Magazine* for January, 1833, accompanied by a drawing and description by a Captain Armstrong, of the particular method of steering from the bow, adopted in the steam-boat Canada, which plies between Quebec and Montreal. The publication of his letter has called forth another to the same journal from our friend Mr. Robert Bowie, who lays claim to the invention of this mode of steering, on behalf of his father-in-law the late William Symington, with whose title to be regarded as the father of modern steam navigation our readers are already familiar. It was, he says, the method actually practised " in the steam-boat experiments (with the Charlotte Dundas) on the Forth and Clyde canal in 1801-2 3;" and he gives in evidence a sketch of that method " furnished by Mr. Symington, jun.:" which sketch, however, we need not extract, as the particular arrangements it embraces will be found sufficiently indicated in the full description of the Charlotte Dundas and her machinery, given in our own journal (No. 475), for September 15, 1832. " When it is borne in mind," adds Mr. Bowie, " that Fulton was on board of Mr. Symington's vessel in 1801, and took sketches of it and its machinery, it will at once become apparent whence the Americans derived their information, and how the plan came to be introduced into that quarter of the world."

NOTES AND NOTICES.

Cylindrical and Dished Wheels.—Institution of Civil Engineers, May 27.—A paper, by Mr. Walker, on the subject of the most advantageous form for wheels of different kinds of carriages, having been read, a member considered that there were some practical objections to the use of horizontal axles, which were not alluded to in Mr. Walker's paper —one, the difficulty of making the wheel perfectly secure from coming off the axle, as a greater strain is unavoidably thrown upon the linchpin. The wheels of ordinary country waggons are usually much dished, and the axles slightly inclined downwards, by which arrangement the principal strain is thrown on the shoulder of the axletree, and a very ordinary description of linchpin will answer the purpose. As far as regards friction, and, consequently, an easy draught for the horse, the straight axle and cylindrical wheel have the preference; but, for safety, strength, and durability, he thought the inclined axle and dished wheel superior. It was remarked that one reason for the conical wheel being so much adhered to in practice, was the greater liability of the tire getting loose on the cylindrical wheel by the constant rolling of a heavy weight frequently on a small extent of surface; the tire becomes slightly elongated, and, on a cylindrical wheel, gets loose, and may occasion accidents; the conical provides against this, by its greater elasticity, and the tendency it has to become more flat in the dishing, and in a slight degree to stretch out the periphery. It was stated that, at first, the cylindrical shape was adopted in Jones's patent iron wheels, but it was found that, with upright wheels, the width of track was required to be seven feet, and some of the streets do not admit of such a vehicle passing; also, in crowded thoroughfares, the nave is exposed and liable to come in contact with other carriages.—It was stated that a wheel of a new construction had lately been attempted, and was likely to become an improvement; the rim and nave are of cast iron, and the spokes of wrought iron; a wooden band is put round the cast-iron rim, which again is surrounded and fastened on by a wrought-iron tire, secured in the ordinary manner.— *Athenæum.*

The Journal of the Asiatic Society contains a well-attested account of a fall of fish from the sky, which took place on the 19th February, 1830, in the neighbourhood of the Surbundy factory, Feridpoor.

New Steam Carriage—(From a Correspondent). On Tuesday evening, the 1st inst., a steam-carriage, on a new principle, invented and constructed by Messrs. Yates and Smith, started from their factory, Colchester-street, Whitechapel, on its first trial. It ran up Whitechapel-lane, along Whitechapel High-street, and returned down Red Lion-street and Leman-street to the factory, at the rate of ten to twelve miles an hour. One of the pipes, which convey the waste steam from the engines to the fire-place, broke at the joint, through a concussion when the carriage first took the very rough paving near the factory, but this did not deter Messrs. Y. and S. from completing their projected circuit, although almost enveloped in steam. In a day or two, when this defect is repaired, it is intended to take the carriage upon the Brighton road. The engines are of the vibrating kind, working in horizontal framing; but the peculiarity of the boiler will not be made public, until the specification is enrolled. The body of the coach, with its fore and hind boots, has the appearance of one of our modern stages.

We are glad to observe, from the newspapers, that Mr. Thomas Steele has revived his laudable project for preserving the house and observatory of the illustrious Newton (in St. Martin's-street, Leicester-square), by enclosing it in a monumental building with a lofty dome—in the same manner as the primitive chapel founded by St. Francis, at

Assisa, in Italy is enclosed by the great Franciscan church of more modern times. The reader will find a full account of this project in our Journal of July 25, 1829; and subsequently (Aug. 22) some critical observations upon it, by two of our architectural correspondents, which are well worthy of attention.

Parisian Steam Carriage.—Last week, Messrs. Dietz and Hermann made an experimental trip with a steam-carriage of their construction, on the road to Vincennes from Paris. This machine, carrying twenty persons, ran from the Barriere du Trone to the Castle of Vincennes, a distance of three quarters of a league, in 11 minutes. It afterwards took an omnibus in tow, in which, and upon the machine itself, there were 48 passengers, and went at the rate of three leagues an hour as far as Nugent. On its return, near the Castle of Vincennes, a tube burst, but it was quickly repaired, and the machine with the omnibus attached to it, and both laden with 53 passengers, reached the Haymarket, Faubourg St. Antoine, in 12 minutes.

Mr. David Napier, engineer, has fitted up an iron boat on a new principle, to sail on the Clyde. A large portion of the boat, below the water-line, is formed into a condenser, and the water outside keeps it cool, so that little (if any) injection-water is required. In this plan, the water pumped into the boiler will not be so salt as if more water were let into the condenser; and an air-pump a little smaller than ordinary will work the engine.—James Whitelaw, *Glasgow, June* 25.

A new locomotive engine, from the foundry of Messrs. George Forrest and Co., was tried, on Monday, on the Railway. It made the journey from Liverpool to Manchester in 67 minutes, and brought back the first class train in 77 minutes. This powerful and rapid engine is intended for the Dublin and Kingstown Railway.—*Liverpool Chronicle, July* 28.

The Society of Civil Engineers has obtained from the Crown a charter of incorporation.

A very ingenious machine has been invented and made solely by Mr. Ackrill, of Boston. It is built to accommodate one person, who will, with great ease (?) be able to propel it at the rate of ten miles an hour. The principle on which it is constructed is entirely new, and may be applied to any purpose in machinery; it is anticipated that it will introduce quite a new theory in mechanics.—*Lincoln Mercury.*

Railway Hunting.—A few days ago, as one of the first class train of carriages on the railway was proceeding at a rapid rate, near Rainhill, a hare sprung up, and, after a chase of three miles, was overtaken by the train, which passed over and killed it on the spot. A crow, which was lately flying across the road, came in contact with the engine, and was killed on the spot.—*Manchester Advertiser.*

The heads of Trinity College, Dublin, have invited the British Association to hold its meeting next year in the Irish capital, and there can be little doubt the invitation will be complied with.

If a vacuum can be produced by the use of a wheel (as described by Dr. Udny, page 200), the same machine may very well be used for the purpose of raising water, and I should imagine with greater effect; for, as the gravity of water is much greater, the ejecting force from the tubes would be proportionate; and if air (subtile as it is) can be disposed of by such means, and a vacuum produced, water, by the same rule, may be raised from 33 to 35 feet.—John Woodhouse, *Kilburn, June* 23.

The inventor of the rotary-engine, noticed at *page* 256 *of our last volume,* desires us to state, *that " the design of it, though* to him at the time *perfectly original,* approximates so nearly to one which he has since found, was invented by Messrs. Richardson and Bramah, 1790, as to offer no superior advantage, with the exception of a little less friction." The plan of Messrs. Richardson and Bramah is described in Mr. Elijah Galloway's work on the steam-engine.

A new method of diffusing light through a theatre has been discovered by a mechanist at Venice. By the aid of parabolic mirrors the light of many lamps is concentrated over an opening made in the ceiling of the theatre, and reflected downwards on a system of plano-concave lenses of a foot in diameter, which occupy the aperture, and convey into the theatre the rays of light which arrive at them parallel and depart from them divergent. From the pit the lenses are alone perceived, which resemble a glowing furnace; and although the luminous focus is sufficient to light the whole of the theatre, it does not dazzle, and may be viewed without fatiguing the eyes. The apparatus being entirely concealed, accommodates itself readily to all the changes which the representation can require. It likewise occasions neither smoke nor bad odours, and has none of the inconveniences of the old system.—*Morning Post.*

New Mode of Ferrying.—" The mode in which we passed the Indus was singular, and, I believe, quite peculiar to this part of the country. We were drawn by a pair of horses, who were yoked to the boat, on each bow, by a rope fixed to the hair of the mane. The bridle is then put on as if the horse were to be mounted; the boat is pushed into the stream, and, without any other assistance than the horses, is ferried directly across the most rapid channel. A man on board holds the reins of each horse, and allows them to play loosely in the mouth, urging him to swim; and thus guided he advances without difficulty. There is not an oar to aid in impelling the boat; and the only assistance from those on board consists in manœuvering a rude rounded pole at the stern, to prevent the vessel from wheeling in the current, and give both horses clear water to swim. They sometimes use four horses; and in that case two are fixed at the stern. These horses require no preparatory training, since they indiscriminately yoke all that cross the river. One of the boats was dragged over by the aid of two of our jaded ponies; and the vessel which attempted to follow us without them, was carried so far down the stream as to detain us a whole day on the banks, till it could be brought up to the camp of our caravan. By this ingenious mode, we crossed a river nearly half a mile wide, and running at the rate of three miles and a half, in fifteen minutes of actual sailing; but there was some detention from having to thread our way among the sand banks that separated the branches. I see nothing to prevent the general adoption of this expeditious mode of passing a river, and it would be an invaluable improvement below the Ghauts of India. I had never before seen the horse converted to such a use; and in my travels through India, I had always considered that noble animal as a great incumbrance in crossing a river."—*Burnes's Travels into Bokhara.*

Communications received from S. C.—Mr. Lawson—R. Batson—Mr. Woodhouse—Mr. Cheverton—Ravacione.

The Supplement to Vol. XX., with a Portrait of William Symington, is now ready, price 6*d.* also Vol. XX., complete, in boards, price 8*s.*

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No. 570. SATURDAY, JULY 12, 1834. **Price 3d.**

THE OBELISK OF LUXOR—ITS TRANSPORTATION TO PARIS.

Fig. 1.

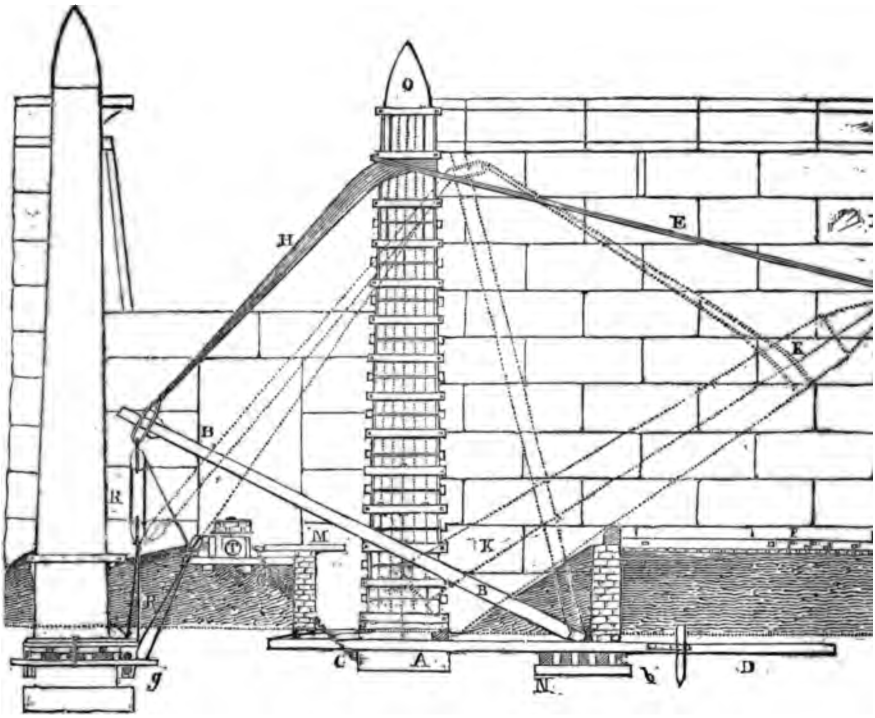
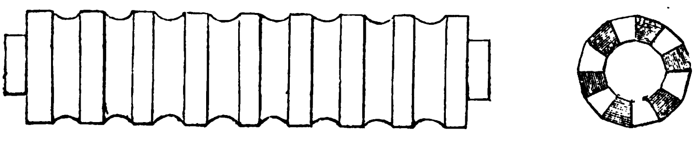


Fig. 7.



ACCOUNT OF THE TRANSPORTATION OF THE OBELISK OF LUXOR TO PARIS.

[Compiled for the Mech. Mag., from "Expedition du Luxor, par M. Angelin, Chirurgien-major de l'Expedition;" and "Notice sur les Obelisques de Luxor," in the *Recueil de la Société Polytechnique*: the latter drawn up chiefly from materials furnished by M. le Comte de Laborde.]

Far from the seats of modern civilisation—beneath the burning sun of Africa—between the waters of the Red Sea and the sands of the Desert—there lies a country, once great and flourishing, but now desolate and forsaken. The traveller, at sight of immense columns levelled with the ground, tall obelisks nearly overwhelmed in sand, and innumerable fragments of statuary of colossal magnitude, salutes with a sentiment of profound respect these august remains of departed grandeur. He asks—who the people were that erected masses so gigantic? By what means, and for what end? He examines a little more closely the magnificent remains before him, and learns from the hieroglyphic inscriptions, still legible upon them, that here, in times long past, lived a warlike and enlightened people; that here reigned the Pharaohs—here the great conqueror Sesostris, who enriched and adorned this remarkable spot with the spoils of all the then known world. Thebes! a name which of itself awakens recollections full of glory—Thebes, the cradle of the arts and sciences—Thebes, the ancient capital of the world—this once mightiest of cities it is, which lies prostrate in the dust. A few miserable Arabs now shelter amidst her ruins, to whom not only her history, but her very name, is all unknown.

Among the surviving monuments of the glory of Thebes, the most remarkable are two immense obelisks, or pyramids, which stand before what bears in modern times the name of the Temple of Luxor, each composed of a single block of granite, about 80 feet high. For more than 3,000 years these pillars must have stood the assaults of time, and yet they are nearly in as perfect a condition as ever. To extract such masses from the quarry, and raise them to their appointed station, must have required all the resources of a mechanical science of the highest order.

Antiquarians inform us that it was a *custom peculiar to* the Egyptians to place such gigantic monoliths as these before their temples and palaces, in order to distinguish them from private dwellings; and that on the sides of them were inscribed, in hieroglyphic characters, the name of the king by whom the palace was erected, or of the deity to whom the temple was consecrated. They were essentially, therefore, historical and sacred monuments; and there can be no doubt that this consideration served, equally with their beauty, to cause them to be so long respected and preserved.

When the merciless Cambyses overthrew the monuments of Egypt, his fury was arrested at the sight of these obelisks; he caused the burning of Thebes to cease, in order that they might be spared.

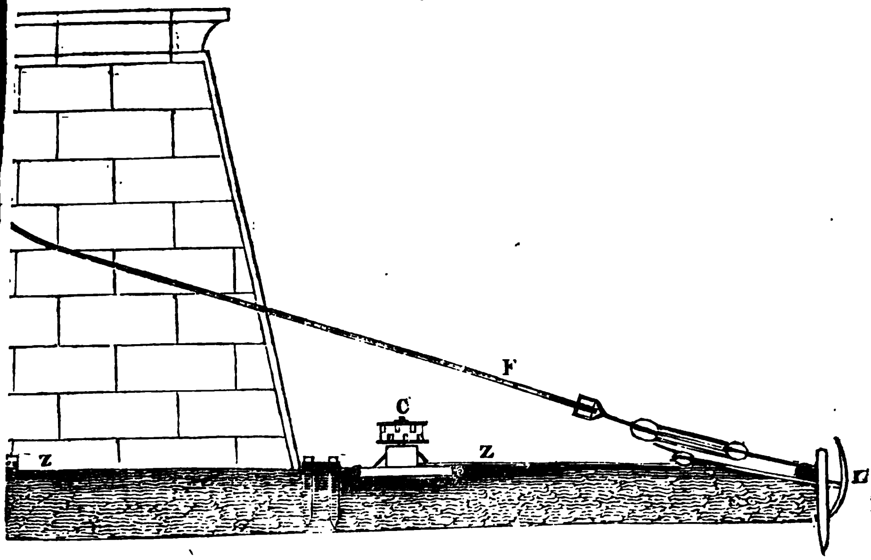
Augustus went farther; he conceived the noble idea of transporting two columns of this description, which he found standing at Alexandria, to the capital of the new world. He found Rome built of bricks, and desired not only (as has been said) to leave it of marble, but to embellish it with a species of stone at that time unknown to the nations of the west, which was said to reflect most brilliantly the rays of the sun, and to look as if spotted with gold.* An immense vessel was constructed for this purpose which conveyed the two obelisks to Rome, where one of them was placed in the Circus Maximus, and the other in the Campus Martius.

It is reasonable to suppose that on this occasion the Romans would spare no pains to ascertain how the Egyptians were able to hew out, transport, and elevate so easily blocks of such enormous dimensions. But whatever their researches were, it is certain that they have yielded little beyond mere conjecture for the information of later times.

The architect of Ptolemy Philadelphus could devise no better means of transporting one of the obelisks of Thebes to Alexandria, than the following very rude method:—He first dug a canal from the spot where the obelisk lay to the Nile—this canal passing beneath the column (transversely), so that the ends rested one on each bank. He next brought under the column two barges, placed them side

* The obelisks were of the red granite of Syene, which may serve to account for the somewhat extravagant description in the text.—Tr.

Fig. 2.



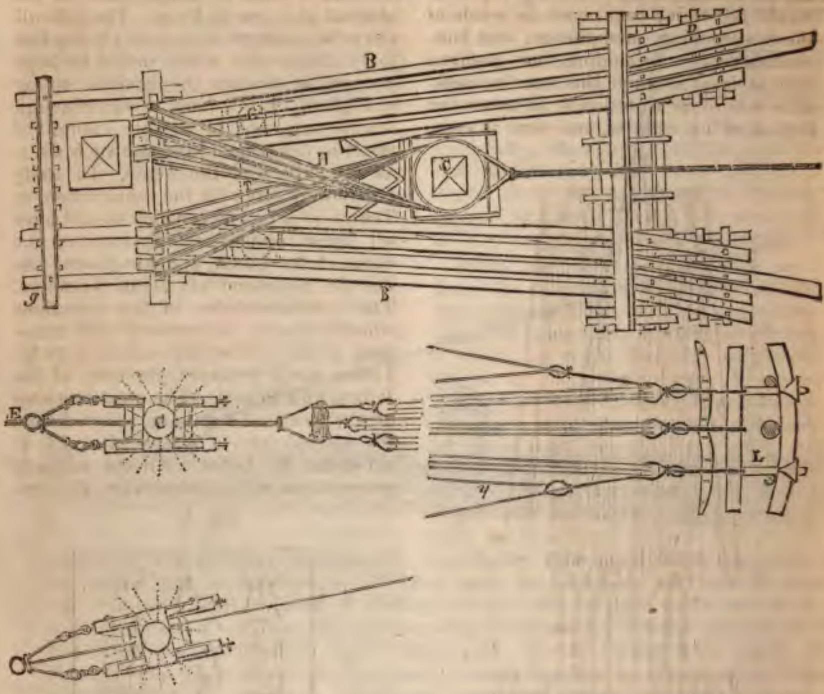
by side, and filled them with weights double that of the column; and then he took out these weights, on which the barge rose, lifted the column along with them, and carried it off. Diodorus Siculus speaks of inclined planes or artificial mounds having been employed—a method made use of to remove heavy weights at the present day by some nations of the East, little skilled in the arts. Pliny tells us that 20,000 men were required to raise one of these obelisks, and that the king's son was fastened to the top of it, to induce them to exert themselves with the proper vigour and address. It would be doing injustice, however, to the well-established skill of the ancient Egyptians in the mechanical arts, to give any credit to such a fable as this. Not only did they raise with facility monoliths such as these—the weight of the heaviest of which did not exceed 700,000 lbs.—but entire temples of one single block, such as those of Sais and Butos, of the enormous weight of from 6 to 8,000,000 lbs.

Following the example of Augustus, Caligula transported to Rome a third obelisk, and the ship or raft employed for the purpose was of so vast a size, that it served under the Emperor Claudius as *a foundation for a tower in the port of Ostia, similar to the Pharos of Alexandria.*

Constantine, ambitious of surpassing all his predecessors in this matter, resolved to transport from Thebes to Byzantium (the modern Constantinople), a still larger obelisk than any which had been yet removed from Egypt. He only succeeded, however, in getting it the length of Alexandria; and, on his death, his son Constans changed its destination from Byzantium to Rome. A vessel was employed to convey it, which is said to have been the largest that, up to that period, was ever constructed. It took 300 rowers to propel it, and the mast was so large that two men could not embrace it. The vessel with its precious cargo reached the banks of the Tiber in safety; but in so low a state were the mechanical arts at that time in Rome, that it required the most unheard-of efforts to unload it. There was constructed for the purpose, says Ammianus Marcellinus, a framework, of so many immense beams, and with such a profusion of cords, pulleys, &c., that it had the resemblance of a forest; and the efforts of several thousand men were necessary to raise the gigantic monolith, in the midst of this most gigantic apparatus.

The trouble which it cost to set up another obelisk, removed at a later period, under the reign of the Emperor

Fig. 3.



Theodosius, to Constantinople, shows still less skill. It appears from an inscription on the pedestal, that it took no less than "thirty-two suns," or days, to raise it from the ground.

The difficulties with which these different operations were attended, prove but too clearly that every trace of the science and skill of ancient Egypt must have been lost.

The incursions of the northern barbarians overthrew the obelisks, along with nearly every other monument of Roman glory; and eight centuries passed away before any thought of raising them again from the dust was entertained. There, in fact, they lay—utterly neglected—almost forgotten—till Rome became a second time the capital of the civilized world.

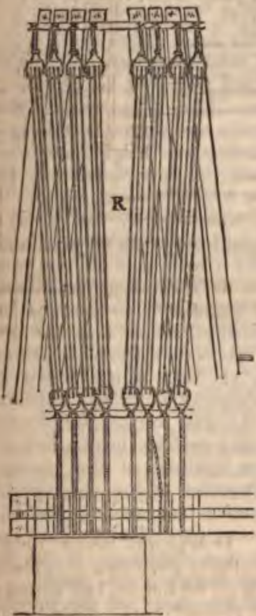
Sextus the Fifth resolved to set up once more the obelisk of Caligula. When his intention became known, there *were many projects* submitted to him for *its accomplishment*; that by Fontana *received the preference*; but what a project! It was the scene described by Marcellinus over again. He employed 800 men, 80 horses, 100 capstans, and a forest of wood-work—triple the power necessary! The operation was, nevertheless, considered so wonderful, that twenty medals were cast to transmit it with due honour to posterity.

After this time, the taste for this description of ancient relics seems to have suffered a long eclipse. Columns, bearing the name of obelisks, were indeed erected at different periods, and in different countries, but they merely consisted of a number of separate blocks put together in a pyramidal form, and bore no other similarity to the genuine Egyptian monolith.

For ten centuries the land of the Pharaohs had remained sunk in barbarism, when there arose in the west a second Sesostris, who conceived the noble design of restoring it to its ancient glory. Led by him the armies of France advanced beyond the Pyramids, nor stopped in their victorious career till in sight

of the magnificent ruins of Thebes. In the enthusiasm of the moment Napoleon would fain have sent home the whole of these surprising monuments; but this, circumstances forbidding, he resolved that at least some of the more remarkable should be transported to adorn the capital of his country, and serve as ever-

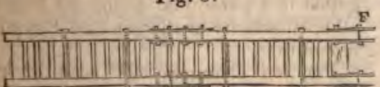
Fig. 4.



lasting memorials of her power and greatness. The interruption of the communications by sea, in consequence of the war with England, put a stop, however, to the accomplishment of this design; and other events soon arrived to cause its entire postponement to a later period.*

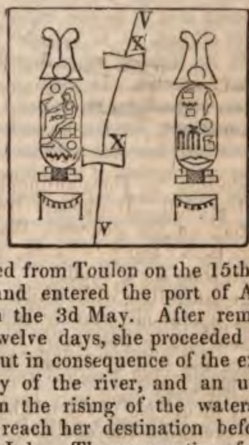
After the lapse of nearly thirty years the scheme of Napoleon was revived by

Fig. 5.



the Government of France, and a determination formed to transport one of the obelisks at Luxor to Paris. The difficulties to be overcome were great; a ship had to be constructed which should be large enough to contain the obelisk, strong enough to bear a long voyage through stormy seas, and of so little draught of water as to navigate with ease such rivers as the Nile and the Seine. In 1829, orders were given for the construction, at Toulon, of a transport which should have all these properties. It received the name of the Luxor, and was placed under the command of Lieut. Verniac. The superintendence of the operations connected with the removal and transport of the obelisk was confided to M. Lebas, naval engineer, formerly of the Polytechnic School. The crew consisted of 120 seamen, 12 artisans, selected from the arsenal, and a master of works, to act under M. Lebas. All the requisite preparations having been made, the ves-

Fig. 6.



sel sailed from Toulon on the 15th April, 1831, and entered the port of Alexandria on the 3d May. After remaining there twelve days, she proceeded up the Nile; but in consequence of the extreme sinuosity of the river, and an unusual delay in the rising of the waters,* she did not reach her destination before the 12th of July. The preparations for lowering and embarking the obelisk occupied from the 11th of July to the 31st of October. The arrangements made for this purpose we shall now proceed to describe.

[To be continued in our next, when an explanation of the accompanying engravings will be given.]

* The historical accuracy of this passage is open to some very obvious exceptions. It may suffice to observe, that the "second Sesostris" contemplated rather a strange way of bringing about the restoration of Egypt *to her ancient glory*, when he *resolved on robbing her of her most precious monuments.*—*Translator.*

* M. Angelin observes on this head — "According to all who have hitherto written of the Nile, the rise commences about the 15th or 20th of June, and continues rising till the 20th Sept. I can bear witness, however, that in 1831 the rise began in the first week of June, while in 1832 there was no rise perceptible before the 1st of July."

THE ASCENT OF SMOKE—POPULAR ERROR CORRECTED.

Sir,—At page 175 of your valuable Magazine there is an inquiry relating to the "ascent of smoke;" with your kind permission I will make thereon a few remarks.

It is demonstrated by writers on hydrostatics, that an equal bulk of a heavier fluid will sink in a lighter, with a force proportionate to the difference of their weights; from which we may deduce, that if our atmosphere were lighter than smoke, then it would be impossible for smoke to ascend. But as it does ascend almost invariably, it follows that the air must generally be the specifically heavier body. Occasionally a very considerable diminution takes place in the density of the air, and consequently in its buoyant power; and then, as your correspondent observes, the smoke ascends with difficulty. Every one must have noticed that this occurs most frequently in damp and foggy weather. The "extreme heaviness" of the air at such times is commonly said to be the cause, though, in point of fact, it is because the air is then in its lightest state that the smoke is slow to ascend. In clear and serene weather, when the atmospheric pressure is the greatest, smoke ascends with almost uniform freeness and ease.

Aristotle's notion of the elements was, that the earth and water were positively heavy, fire positively light, and air not positively either the one or the other. Hence his followers affirm, that the ascent of bodies is owing to their intrinsic levity; but it is now universally agreed that this doctrine was wholly erroneous. Bodies ascend—flame and smoke, for example—not because they are intrinsically light, but only because they are lighter than some other body or medium on which they are dependent. It is a well-known fact, and one which helps considerably to strengthen this view of the matter, that smoke in an exhausted receiver settles to the bottom in a darkish body, leaving the upper part clear and transparent; which is not because the air is too *heavy*, but obviously because it is too light to afford the requisite support.

May we not, however, reasonably suppose *that smoke itself* may, at different *times, undergo some slight* alteration in *heaviness?* *Or, at least,* that smoke, arising from fires composed of different materials, may be of different weights? Some time ago I witnessed a very singular phenomenon. Almost close to where I reside there is a lime-kiln; it had not been long kindled, and the smoke issuing from it instead of ascending, as it commonly does, appeared to creep along the ground, about a foot in height, and when it came to the edge of the bank, on which the kiln is situated, it *rolled down* in beautiful curls, almost as if some one were pouring dust from the bank; the smoke was of a muddy colour. After it had reached the ground it slowly crossed a canal, continuing about the same height, and when it had reached the opposite side it was taken off by a gentle south wind. While we stood watching it, the wind suddenly changed from south to west, and almost directly it was taken off the ground, and rose in the air as smoke commonly does. Now, though the smoke must have been specifically heavier than the air around it, as was certain from its rolling downward, yet that which issued from the neighbouring chimneys appeared not to have the least inclination to come down. This may possibly have arisen from the greater lightness of the atmosphere, at the elevation of the chimney-tops; but it seems to me more probable, that it was owing partly (only) to that cause, and partly to a difference in the density of the two descriptions of smoke.

Perhaps many of the inhabitants of London are not much wiser than are the inhabitants of the country, even in such simple matters as these; yet one would imagine that, in a city which is so troubled with smoke, even the most illiterate would not be ignorant of the cause of its not always ascending with equal rapidity. It would be as reasonable to expect that a ship, or a cork, should be more buoyed up in fresh than in salt water, as to suppose that smoke should be kept down by the air being too dense. Hydrogen gas being twelve times *lighter* than common air, is employed to fill balloons; but if the "heaviness" of the air were the reason why smoke will not ascend, why not find some gas which is twelve times *heavier* than common air for the same purpose?

I am, Sir, &c.

J. L.

Bulbourne, June 21, 1834.

ACCOUNT OF SIR J. F. W. HERSCHEL'S OBSERVATIONS ON NEBULÆ AND CLUSTERS OF STARS, MADE AT SLOUGH, WITH A TWENTY FEET REFLECTOR, BETWEEN THE YEARS 1825 AND 1833, AND PUBLISHED IN "PHILOSOPHICAL TRANSACTIONS" FOR 1833.

[Hitherto our knowledge of a most interesting class of celestial objects, the nebulæ and clusters, has been very limited. The little information that had been obtained did not exist in a form in which it could be used with facility, since nothing like a practically-arranged catalogue of them was in print. With the exception of Messier's list of 103 conspicuous ones, whose places were determined about the middle of the last century, the only fund of information existed in the papers of Sir W. Herschel, in the "Philosophical Transactions." These contain observations of 2,500 nebulæ and clusters, in three successive portions, and divided into eight classes; but his method of exhibiting their positions, consisted merely in setting down their differences of R. A. and P. D., as compared with certain preceding or following stars of the British Catalogue. Most of these objects are so faint as to require a very large telescope to discern them, whilst others come within the scope of more ordinary instruments; but none of them could be rediscovered without a tedious calculation of their places from the differential positions assigned by Sir William. It follows, that the converse operation, to ascertain whether any nebulæ found in the heavens had previously been noted by Dr. Herschel, was still less practicable. Of the nebulæ and clusters contained in the "brief but important" original list of Messier, which includes some of the most conspicuous in the heavens, Dr. Herschel gave scarcely any account. In two papers contributed by him to the "Philosophical Transactions" of 1811 and 1814, he took a general review of his observations, under the title of "Remarks on the Construction of the Heavens." These two papers are illustrated by plates of nebulæ and clusters, which, however, are not individual, but generic representations.

Sir John Herschel, who, to the practical management of a large telescope, adds the mathematical acumen and industry requisite for the reduction of observations into an available form, has been engaged, for eight years before he left England, in observing double stars, nebulæ, and clusters. His labours upon the former objects have been recorded in the "Memoirs of the Astronomical Society;" those which relate to the rest were communicated to the Royal Society in the Paper now under consideration. He has re-examined 1,800 of those recorded by his father, and added 500 new ones, besides giving a full account of 72 of Messier's List. All these objects, reduced to their mean right ascensions and polar distances for 1830, progressively numbered, and arranged in the order of transit, form a catalogue occupying 117 quarto pages. About 70 of the most interesting objects are also graphically exhibited, in the performance of which latter task both the observer and engraver must have encountered great difficulty.]

It was the author's intention to have deferred the publication of these observations until he should have been able to present their results in the more complete form of a general catalogue of nebulæ and clusters visible in this latitude; in which *all* his father's should have been included, and their places determined by at least two observations. To have done this would have required several years additional work; and the want of an extensive list, arranged in the order of R. A., having, since the recent improvements in the achromatic telescope, and the increased assiduity of astronomers in the detection and observation of comets, become continually more pressing, and the deficiency more and more complained of, he thought it on the whole a preferable course to supply that deficiency as far as he was able, although the catalogue might be wanting in that precision and completeness which, as yet, he was unable to give it.

The author's mode of observing, the general character of the instrument employed, and the principal sources of error to which its determination of the places of objects is liable, are stated with considerable detail in his five catalogues of double stars discovered with it, published in the "Memoirs of the Astronomical Society." But a much greater latitude of error must, unavoidably, subsist in observations of nebulæ. Many of them present a large and ill-defined surface, in which it is not always easy to say where the centre of greatest brightness is situated. Vast numbers of them are so extremely faint as to be with difficulty discerned at all; and in some parts they are so crowded as scarcely to admit of any interval between their transits; in others whole hours elapse without a single nebula occurring in the zone then under examination. When it is considered that it is only in March, April, and May, that the richer parts of the heavens can be advantageously observed, and then only in the complete absence of the moon and of twilight, and that it is not only the number, but the variety and interest of the objects that distract attention, it will be seen that there are not many nights in which it is possible to make great progress in a re-

view of nebulæ, and that, in fact, there is hardly any branch of astronomy which has a greater tendency to create a sense of hurry, so fatal to exact observation.

Among the 500 objects, recorded as "new," the author can call to mind only one very conspicuous and large nebula, and only a very few entitled to rank as "bright nebulæ." By far the greater proportion of them are of the last degree of faintness, only to be seen under most favourable circumstances. This is mentioned to show both the rigorous nature of Dr. Herschel's scrutiny, and the degree of completeness to which our knowledge of the nebulous contents of the northern hemisphere has already attained.

The difficulty of making satisfactory representations of these objects is extreme; and of those which accompany this paper, the author is rather disposed to apologise for the incorrectness than to vaunt the accuracy. Among the figures are some very extraordinary objects, which have not hitherto been sufficiently pointed out to the notice of astronomers, and of which, indeed, some of the most remarkable peculiarities have escaped every former observer. These are briefly noticed in the descriptions appended to each observation, and more distinctly at large in the explanations of the plates. The mere inspection of the figures will produce a conviction that many of these mysterious objects possess a symmetry of parts and a unity of design, which, singular as their constitution must appear, strongly mark them as systems of a definite nature, each complete in itself and subservient to some distinct purpose, the nature of which it is in vain for us to conjecture.

[We here insert the catalogue of figured objects, arranged, however, in the order of R. A., with two columns added, one specifying the constellation, the other the dimensions. It is with considerable reluctance that we confine the list to this number, since the general catalogue presents numerous other nebulæ, &c., equally worthy the notice of the amateur. In the first column, the letter M refers to Messier's list, the Roman numerals to the classes of Dr. Herschel's catalogues. Where a number *only* is given, it is that of the present catalogue, and denotes an object not identified with any previous observation. The great nebulæ of Orion and Andromeda are not included; they are described, and the former figured, in "Memoirs of the Astronomical Society," vol. ii. They are *both* figured in "Cabinet Cyclopædia," vol. *Astronomy*.]

Designation.	Constellation.	R. A.		N. P. D.		Size.
		h.	m.	°	′	
V. 1	Appar. Sc.	0	39·2	116	13	
II. 252	Pisces	1	15·0	77	58	3′
IV. 42	———	1	40·1	84	56	
V. 19	Androm.	2	12·0	48	25	3½′ l.
I. 156	Perseus	2	29·8	51	41	5′ l.
IV. 69	———	3	58·6	59	41	
I. 261	Auriga	5	20·2	55	54	
M. I.	Taurus	5	24·3	68	7	4′ l.
M. 78	Orion	5	38·0	90	1	5′
IV. 2	Monoc.	6	29·9	81	7	1′ l.
VI. 2	Gemini	6	45·3	71	49	5′
II. 316, 7	———	7	14·8	60	11	
II. 280	Hydra	8	45·8	92	25	
IV. 66	Urs. Maj.	8	46·6	35	35	
I. 56, 57	Leo	9	22·5	67	46	3′ l.
IV. 60	Urs. Maj.	10	28·1	35	37	15″
M. 97	———	11	4·8	34	4	2½′
M. 65	Leo	11	10·0	75	59	4′ l.
V. 8	———	11	11·4	75	29	15′ l.
875	———	11	14·2	76	5	6′ l.
II. 103	———	11	31·4	73	43	
I. 95	Can. Ven.	12	7·1	52	44	50″
I. 109	Virgo	12	7·2	75	54	7½′ l.
V. 43	Can. Ven.	12	10·5	41	45	6′ l.
M. 61	Virgo	12	13·2	84	35	
I. 210	Can. Ven.	12	15·1	42	4	50″ l.

Designation.	Constellation.	R. A.		N. P. D.		Size.
		h.	m.	°	′	
V. 29	———	12	17·5	55	32	10′ l.
I. 92	Com. Ber.	12	27·5	61	6	4′ l.
V. 24	———	12	27·9	63	5	15′ l.
1358	Virgo	12	27·9	77	48	4′
III. 602	———	12	28·5	74	48	
I. 43	———	12	31·2	100	40	5′ l.
V. 42	Can. Ven.	12	33·9	56	31	15′ l.
M. 60	Virgo.	12	35·1	77	31	double.
I. 176, 7	Can. Ven.	12	35·7	56	54	
M. 94	———	12	42·9	47	57	2½′
II. 75	Virgo	12	44·6	77	51	30″ l.
M. 64	Com. Ber.	12	48·4	67	23	7′ l.
IV. 30	Can. Ven.	12	50·9	54	13	
I. 143	Virgo	12	52·0	86	35	
M. 51	Can. Ven.	13	22·7	41	56	
II. 297	Virgo	13	28·9	107	1	2′
II. 751, 2	Bootes	15	0	69	48	double.
M. 5	Serpens	15	9·9	87	16	2½′
1929	———	15	29·2	83	27	2¼′
M. 13	Hercules	16	35·6	53	13	7½′
1989	———	17	44·7	66	53	
IV. 41	Ophiuch.	17	52·0	113	1	7′
2002	Serpens	18	7·0	109	56	50″
M. 17	Scut. Sob.	18	10·8	106	15	15′
M. 57	Lyra	18	47·2	57	11	68″
IV. 51	Aquil. & A.	19	34·4	104	33	10″
IV. 73	Cygnus.	19	40·3	39	54	35″
M. 27	Vulpec.	19	52·2	67	44	6′
IV. 13	Cygnus.	20	9·5	59	57	40″
IV. 16	Sagitta.	20	14·8	70	26	20″
V. 15	Cygnus	20	38·6	59	54	30′ l.
V. 14	———	20	49·4	58	57	60′ l.
2093	———	20	50·1	60	26	
IV. 1	Aquarius	20	54·9	102	2	20″
M. 2	———	21	24·7	91	34	1½′
M. 30	Capricorn.	21	30·7	113	55	6′
II. 450, 1	Aquarius	22	51·2	103	43	double.
I. 55	Pegasus.	22	56·4	78	36	2′ l.
II. 600	Androm.	23	14·0	50	5	2½′ l.
IV. 18	———	23	17·7	48	24	30″
II. 226	Pegasus.	23	20·0	68	31	

REMARKS ON THE NEBULÆ AND CLUSTERS COMPRISED IN THE PRECEDING LIST.

M. 51. This very singular object is described by Messier as double, two bright centres distant 4′ 35″, the two atmospheres touching. By this it is evident that the peculiar phenomena of the nebulous ring, which encircles the central nucleus, was not seen. Dr. Herschel describes it as a bright round nebula, surrounded by a halo at a distance from it, and having a companion. But its novel and most interesting feature to our author is, the partial subdivision of the ring into two branches, throughout its south following limb. Supposing it to consist of stars, the appearance from a particular spot would be exactly similar to that of our Milky Way, traversing, in a manner precisely analogous, the firmament of large stars, into which the central cluster would be seen projected. Can it, then, be that we have here a brother-system, bearing a real physical resemblance and strong analogy of structure to our own? Were it not for the subdivision of the ring, the most obvious analogy would be that of the system of Saturn; and the ideas of Laplace, respecting the formation of that system, would be powerfully recalled by this object.

M. 27. Messier calls it oval. Dr. Herschel perceived the true form, that of a double-headed shot or dumb-bell. But here, as in the former object, the feature which gives a

peculiar interest to the whole nebula, has been hitherto overlooked, viz. the faint nebulosity which fills in the lateral concavities of the body, and converts them, in fact, into protuberances, so as to render the general outline an ellipse, having for its shorter axis the common axis of the two bright masses of which the body consists. To this axis the complete figure is symmetrical.

M. 64. The dark semi-elliptic vacancy, which partially surrounds the condensed and bright nucleus of this nebula, was seen by Dr. Herschel. Sir Charles Blagden likened it (not inaptly) to *a black eye.*

V. 19. Is an extraordinary object. There can hardly be a doubt of its being a thin flat ring, of enormous dimensions, seen very obliquely. It is of the last degree of faintness.

M. 57. The annular nebula in Lyra. Rather elliptical. The edges exhibit a curdled and confused appearance. The interior is far from absolutely dark: it is filled with a feeble nebulous light, not noticed by former observers. The annular form, or an approach to it, is one of those which nebulæ affect; and, taken in connexion with Saturn's ring and the Milky Way, may lead us to conceive that some kind of analogy, however obscure, may subsist in all those cases.

V. 15. From *k* 52 Cygni, northwards 27′ extends a curved tail of nebula, of a serpentine form, fading very gradually into two tails forming a fork. Its general direction is in the meridian. It also extends southward of the star (a double one), but is extremely faint.

M. 17. The figure of this nebula is nearly that of a Greek capital Ω, somewhat distorted, and very unequally bright. Messier perceived only the bright preceding branch, without any of the attached convolutions, which were first noticed by Dr. Herschel. The chief peculiarities which his son has observed in it are, 1st, the resolvable knot in the following portion of the bright branch, which is in a considerable degree insulated from the surrounding nebula, strongly suggesting the idea of an absorption of the nebulous matter; and, 2dly, the much feebler and smaller knot at the N. prec. end of the same branch, where the nebula makes a sudden bend at an acute angle.

V. 24. }
I. 43. } The strong suspicion of a parallel appendage to the latter of these is almost converted into a certainty by its undoubted existence in the former. But what are we to make of such an appendage? Must we consider it as an extreme exaggeration of the case of M. 64, in which the vacancy is extended up to almost the very extremities of the elliptic outline,—in which case the nebula would come to be regarded as a flat annulus seen at a great obliquity, and having very unequal breadths and densities in its two opposite semicircles? Or must we admit the appendage to be a separate and distinct nebula, dependent, by some unknown physical relation, on its brighter neighbour.

No. 2002. A fine double star, involved in a pretty bright large oval nebula.

IV. 69. A star of 8th mag., with a fine nebulous atmosphere, fading away to nothing.

M. 97. A large round uniform nebulous disc. A most extraordinary object.

V. 14. An extremely faint bifurcated nebula, very large and straggling. It is at least a degree long, passing obliquely through and rather south of a small constellation.

M. 78. A very large, wisp-shaped nebula, involving three stars.

II. 252. }
II. 297. }
IV. 60. }
M. 94. } Round nebula with brighter centres, in progressive rank, the first being very gradually a little brighter, the last very suddenly much brighter, in the centre.

No. 1989. A small, round, very perceptible disc, 1″ or $1\frac{1}{2}''$ diameter, with a very faint nebula surrounding it. A curious object.

IV. 73. A star 11th mag., surrounded with a very bright, perfectly round, planetary nebula. Dr. Herschel observes that this remarkable object appears to constitute a connecting link between the planetary nebulæ and nebulous stars. It differs from the latter class of objects in respect of the intensity and comparatively sharp termination of the surrounding light; and no less from the former in that of its stellar centre.

IV. 1. }
IV. 18. }
IV. 51. }
IV. 16. } Four fine planetary nebulæ, round and of uniform brightness throughout the respective discs. Each has one or more minute stars adjacent, suggesting the idea of accompanying satellites. Such they may possibly be. The enormous magnitude of these bodies, and consequent probable mass (if they be not hollow shells), may give them a gravitating energy, which, however rare we may conceive them to be, may yet be capable of retaining in orbits, three or four times their own diameter, and in periods of great length, small bodies of a stellar character. The angles of position of the companion stars should therefore be watched.

IV. 13. Is another planetary nebula, a miniature of the annular nebula in Lyra, having a darkness in the middle.

I. 261. A nebula, including a triple star, forming an equilateral triangle—a most curious *object.*

I. 43. Very bright, long, with a nucleus.
V. 8. Very long narrow ray, most curious.
V. 1. Very long and bright.
M. 65. Extended, with a round nucleus.
No. 875. Very large and bright, suddenly much brighter in middle.
V. 43. Very large and bright, oval nucleus, which is not in middle of its length.
I. 156. Very bright, suddenly much brighter in middle, to a star.
I. 210. Very bright, small, a star with a short sharp ray.
IV. 42. A star 9th mag., with very faint, narrow ray.
I. 109. A very remarkable long ray.

These are ten instances of long nebulæ, all with nuclei more or less bright and distinct. The general form of elongated nebulæ is elliptic, and their condensation towards the centre is almost invariably such as would arise from the superposition of luminous elliptic strata, increasing in density towards the centre. In many cases (as in M. 65), this increase of density is obviously attended with a diminution of ellipticity, or a nearer approach to the globular form in the central than in the exterior strata. It is probably owing to this, that extended nebulæ, seen in dull or hazy states of the sky, are often described as *round*, the fainter and more elliptic envelopes being obliterated, and only the more globular nuclei perceived. The great extension of some nebulæ into long lenticular rays, and the existence of every intermediate degree of elliptricity up to the exact circular form, with the various degrees of rapidity of central condensation, from a barely perceptible increase of density to a seemingly solid nucleus, are all accounted for by supposing the general constitution of these nebulæ to be that of oblate spheroidal masses, of every degree of flatness, and of every variety in their laws of density and ellipticity.

II. 600.
II. 280.
IV. 30.
I. 55.
Are faint, narrow rays extending between two stars.

IV. 2.
IV. 66.
III. 602.
I. 143.
Stars with fans, brushes, or cometic tails connected with them.

V. 29.
I. 95.
II. 316, 7.
II. 450, 1.
Double nebulæ, round, equal size, more or less separate.

M. 60.
M. 61.
I. 56, 7.
M. 63.
Double nebulæ, roundish, unequal size and brightness.

I. 176, 7. Two long neb., oblique, seem to cross or cut each other.
II. 751, 2. Two long neb. in one line.
No. 1358. Two long neb., nearly parallel.
V. 42. A round and a very long neb., with a star 10th mag. between.
II. 103. A long neb. with a round one at the end of it.

All the varieties of double stars, as to distance, position, and relative brightness, have their counterparts in double nebulæ; besides which, the varieties of form and gradation of light in the latter, afford room for combinations peculiar to this class of objects. On examining those specified in the margin, and a great number of similar ones which the catalogue embraces, it will be impossible to refuse our assent to the idea of a more intimate physical relation between the individuals of a double nebula than that of mere casual juxtaposition. The argument drawn from the comparative rarity of the objects, in proportion to the whole extent of the heavens, so cogent in the case of the double stars, is infinitely more so in that of the subjects now under notice. Nebulæ, for instance, so large and faint, and so little condensed toward the centre as those of V. 29, are extremely rare, even single, so that the improbability of two such casually occurring so near together as to intermix their nebulosities, is extreme. It will become an interesting subject of future inquiry, whether any traces of orbitual motion can be detected in these combinations.

IV. 41. Three nebulæ, with a vacuity in the midst, in which is centrally situate a beautiful triple star. Dr. Herschel and Mr. South had previously seen this star as double only. The whole forms a most remarkable object.

I. 92.
II. 74, 75.
II. 226.
Other nebulæ, which offer remarkable peculiarities of situation with regard to stars.

No. 2093. A most wonderful phenomenon. A very large space 20′ or 30′ broad in P. D., and 1^m or 2^m in R. A., full of nebula and stars mixed. The nebula is decidedly attached to the stars, and is as decidedly not stellar. It forms irregular lace-work marked out by stars, *but some parts are decidedly nebulous*, wherein no stars can be seen. It is an extremely *faint and difficult object.*

M. [illegible] Are six clusters of stars, beginning with a barely resolvable one, and ascending by successive degrees to M. 13, which is one of the most magnificent masses of stars the heavens contain; the stars are from the 10th to the [illegible] mag. and many thousands in number. These clusters are instructive, [illegible], as they do, an analysis of the intimate structure of nebulæ, on which depend many of the peculiarities of their appearance, when no stars can actually be discerned in them; such as, for example, that peculiar character termed [illegible] "filamentous," and which is well illustrated by the cluster last mentioned, as well as by M. 33 (R.A. 19h 45m, P.D. 70° 55′), the border, instead of melting away [illegible] having a ragged or fibrous appearance. VI. 2 is an acutangular cluster, brightest [illegible] the preceding part.

A considerable number of Dr. Herschel's nebulæ have not been found in the places [illegible] but the greater part of them are of that extremely faint class, that they are easily [illegible] in the field of view.

J. W. W.

THE PHENOMENA OF FLAME—MR. WITTY IN EXPLANATION.

S[illegible]—I have been much interested by [illegible] the letter of Mr. Watson, page [illegible] and also the two communications of Mr. Rutter, page 140 and [illegible]. With your [illegible] leave to submit the [illegible].

The [illegible] phosphorus in the interior of the flame of alcohol, appears to [illegible] as [illegible] sufficiently proved. [illegible] that statement, I had [illegible] the experiment, and, [illegible] that I relied too [illegible] of Dr. Ure. I [illegible] experiment, and, as [illegible] the vaporised [illegible] till it had [illegible] flame of the alcohol.

[illegible] appears to have misunderstood [illegible] when I spoke of the [illegible] appears to surround [illegible] I will make it [illegible] observing, that I [illegible] appearance which [illegible] from every [illegible] flame. The [illegible] I have described [illegible] as the combustion [illegible] envelopes the [illegible] flame, or that part [illegible] of carbon, with [illegible]

[illegible] experiments of Mr. [illegible] agree with my [illegible] principally [illegible] of oxygen [illegible] flame. And [illegible] has done in a [illegible] though I may [illegible] attempted to [illegible] phenomena of a [illegible] did not expect to find oxygen in that part of the flame occupied by vapour; I mean tallow in a state of vapour, as it rises from the wick. Neither would any chemist be overburdened with a knowledge of his subject, who expected to find much oxygen in a greasy vapour; or even in the interior cavity of an Argand gas-burner, when the air is excluded from the central opening. The flame of alcohol is merely the combustion of the decomposed vapour of alcohol; this vapour, as it rises to supply the flame, fills the interior cavity, and certainly it is no great wonder that a taper is extinguished when plunged into this vapour. But the difficulty I attempted to explain still remains the same. In my first communication, I objected to Sir H. Davy's definition of flame; Mr. Rutter does the same, but the conclusions he comes to, differ much from what I conceive to be the proper explanation. In fact, Mr. Rutter leaves the subject without even attempting to explain the chief difficulty, which is to account for the appearance of oxygen in the interior of flame. In drawing his conclusion, as to the chemical phenomena exhibited in the flame of a candle, page 145, Mr. Rutter says, "The blue portion of the flame, at its base, as well as the fainter film of blue that surrounds its other parts, denotes the chemical union of carbureted hydrogen and oxygen gases." If this be so, then it is the combustion of an explosive mixture, according to Mr. Rutter's own references. Mr. Rutter says, "That all the vapour arising from a combustible body is not, excepting under particular circumstances, converted into gas, is abundantly evident by the free carbon (smoke) that arises from a candle,

a lamp, and a coal fire." But I ask, whether it be possible to obtain carbon from tallow, without that carbon is first caused to exist in a state of gas, and in chemical union with hydrogen?

To return to what I consider the chief difficulty of the subject: in the flame of alcohol may be distinctly observed the appearance of two flames; the inner one is sometimes white and luminous (from the presence of carbon), the outer one is blue, and in some cases appears full ¼ of an inch in depth. A third flame, of an orange colour, may be produced by making the alcohol boil with a red hot wire, and the question is, how does the oxygen get to the inner flame?

The flame of a candle is another instance, as it appears to be enveloped with a thin sheet of blue flame, extending to about ⅔ds of its height. How then does the oxygen get through this thin flame, to supply the carbon which exhibits such a brilliant combustion beneath? This Mr. Rutter has not attempted to explain.

The flame produced by the combustion of an explosive mixture (oxygen and hydrogen), through a small aperture, has always appeared to me a singular circumstance; for the explosion of a large volume of the mixed gases is so instantaneous, that reasoning from this fact, we might expect to find the flame extending no more than an eighth of an inch from the jet, though, on experiment, we find the flame several inches in length. The explanation of this appears to me as follows:—When the gas, as it issues rapidly from the jet, is first lighted, an *instantaneous* union takes place, and water is formed, which, owing to the heat, immediately becomes vapour; but as this vapour is not *instantly* removed, the next portion of gases is so mixed with it that the quickness of their union is prevented, the vapour impeding the passage of the particles, one to the other, and perhaps destroying in some measure their attractive force. Now in this union there are three substances present, and, I believe, that the more substances the slower must be the union, as the particles and different attractions must interfere with one another. Now, in the case of a candle, four substances are present in the flame, viz., oxygen, hydrogen, aqueous vapour, and carbon. The thin film of blue flame, at the outer surface, I consider to be hydrogen; this *attracts* oxygen from the air, but owing to the aqueous vapour the union is not instantaneous; and the attraction of carbon for oxygen being very great, at that high temperature, enables it to seize some of the oxygen attracted by the hydrogen. If this be the right explanation, we can account for the sudden union of gases in an explosive mixture of oxygen and hydrogen, for the particles are not impeded in their attractions, and consequently their union, as we find by experiment, is almost instantaneous. Explosive mixtures of oxygen and hydrogen combine with much greater violence than explosive mixtures of oxygen and carburetted hydrogen; the different attractions of the carbon and hydrogen, in the latter case, interfering in some measure with that rapidity of union which takes place when only two substances are present. How brilliant is the combustion of those substances in oxygen gas where solids are formed by the union, such as phosphorus and the metals! This is, doubtless, owing to the rapidity with which the phosphoric acid, on the metallic oxide, gets out of the way, so as not to impede the union of fresh portions of the two substances. How much again the union of carbon with oxygen is impeded by the formation of carbonic acid! Remove this as quickly as formed, by urging a stream of air on the burning substance, and intense chemical union then takes place. On the same principle, lecturers on chemistry might exhibit their experiments to much greater advantage than they do at present, by urging a stream of oxygen upon red hot metals, or burning phosphorus, &c. &c. Chemical action would then be in perfection, and appear more brilliant and intense than by the mode usually adopted.

I now beg leave to notice Mr. Rutter's reply to my letter. Mr. Rutter cannot conceive the possibility of aqueous vapour being projected into the interior of flame; how then is it projected from flame? The vapour, when formed, expands in every direction alike, and consequently is projected into the flame, that is, among the particles of carbon. The velocity of the expanded vapour is no doubt very great, owing to the extreme heat to which

it is subjected on its first formation, and the vaporous current, Mr. Rutter speaks of, moves so slowly in comparison, as not much to affect it. Mr. Rutter cannot understand those mysterious movements in the flame of a candle which I mention, and says,—"Moreover, the theory of combustion as exhibited in a candle, is perfectly intelligible, without having recourse to any such rapid movements" as are hinted at by your humble servant. Now, Mr. Rutter will oblige me, and, no doubt, many others of your readers, by making this difficult subject perfectly intelligible. The numerous experiments related by that gentleman, together with his remarks and conclusions, cannot fail of being interesting and instructive to all who read them; but the simple, or rather the complex, phenomena presented in the flame of a candle, will require further consideration and reflection, before they are made to appear in such a way as to be "perfectly intelligible."

It is hardly necessary for me to say any more as to the burning of coal-tar, since my design was merely to show how it might be done, and had no reference to the "cost of the process." At present I pass over Mr. Rutter's explanation of the obscure paragraph, as well as his theory of the combustion of coal-tar and water, which I can hardly agree to. I will send you my ideas at some future period, when I have given the subject more consideration. It is not an easy thing to exhibit the luminosity of heated air, but I think there are some grounds for supposing that it would be slightly luminous when sufficiently heated. The air escaping from the chimneys of some furnaces appears at night as a luminous column, though it may be objected that the light is derived from the fire, and refracted by the air. That the *surfaces* of boilers are sometimes red hot, may be ascertained in boilers that are much forced, by looking through a hole in the flue, when the fire is burning clear; this is where I have seen indications of a red heat: another proof is that the carbon adhering to the metal when the fire is first lighted, disappears when the fire burns violently and the water begins to boil.

I remain, Sir,
Yours respectfully,
William Witty.

London, July 4, 1834.

COMPOSITION OF CHINESE GONGS.

In the *Annales de Chimie* there is the following account of the Chinese process of manufacturing gongs and cymbals, translated by M. St. Julien, from the "Teen-kong-kae-weh," a Chinese Encyclopædia of Arts and Manufactures:—

"The red copper used in making musical instruments must be alloyed with mountain tin,* which does not contain a particle (*literally* a vapour) of lead. In order to make gongs, &c., 8 lbs. of copper are alloyed with 2 lbs. of tin. If you wish to make little bells or cymbals, the red copper and the tin must be much purer and finer than for gongs.

"When a gong is to be made, it must not be cast in the form it is to have, and then forged with the hammer. You must begin by founding a thick sheet of metal, which must be cut round, and then beaten with the hammer. For this last purpose the round sheet of metal must be spread upon the ground; and if the instrument is required to be of large size, four or five workmen must be placed around to hammer it. The sheet will spread out and enlarge under the hammer, and its edges will rise up. Then the instrument will begin to emit sounds resembling those of a musical cord. All these sounds proceed from the points which the hammer has struck (*literally* from the points struck by the *cold* hammer). In the centre of this drum of copper a boss or round elevation is formed, which is struck, and the blows of the hammer give it the tone. Two tones are distinguished in the gong—the *male* tone and the *female* tone. Both depend upon the rising being less or greater than ought to be given, with rigorous exactness to the boss, according as one or other is desired. By doubling the blows of the hammer, the instrument acquires a grave tone."

M. D'Arcet, in a note upon this translation, observes:—

"The only thing I find correct in this account is the composition of the alloy, of which the Chinese author states these instruments are formed. I have analysed seven gongs and twenty-two cymbals, and I have always found in one hundred parts about eighty of copper and twenty of tin. It is true, about five or six years ago, an original letter was communicated to me from a missionary, which stated that gongs contained, besides copper and tin, $\frac{8}{100}$ of bismuth; but the properties of this alloy, and the result of the analyses just mentioned,

* The Chinese have two sorts of tin, mountain tin and river tin; both are found in the provinces of Kwang-see.

; the workman deceived the mis- this point. I regard, then, as a d, that these gongs and cymbals sed of an alloy formed with eighty er and twenty tin; but this is far cient to enable us to fabricate ruments; for this alloy is as brit- s, and if it be used as it comes crucible, it would be not only im- forge it, but even to use such in- , merely cast with this alloy with- breaking. This happened to an d gong, which was made at the Châlons for the King of Prussia, gong at the opera, which, being was heated in order that it might l with silver solder. The alloy of ts copper and twenty of tin is so pecially when hot, that it may be powder. This alloy has great its grain is very fine, and its frac- st as white as that of bell-metal. ongs and cymbals, on the contrary, all specific gravity, and a fibrous xhibiting the colour of the alloy parts copper and ten tin, used for Fragments of gongs and cymbals, reaking under the pestle, are mal- d may, moreover, be bent till the of the piece form together an angle r 140°, without breaking. It fol- ly from this comparison, that cymbals cannot be fabricated, as se author pretends; that it is only of some peculiar process, some hand, that an alloy of eighty parts d twenty tin can be employed in afacture. The secret consists in the alloy; in fact, when heated to erry-red, and plunged into cold takes instantly all the physical of the gong and cymbals. I have ired by this process upwards of of cymbals, and experience has fied what I have stated.

ng is said in the Chinese ac- out tempering, yet, without this it is impossible to fabricate these As to the mode of making them, of eighty parts copper and twenty when tempered, cannot possibly , and especially beaten out. All se author says about casting the e form of a plate, and beating it he hammer, is a mere fiction im- n him by a Chinese artificer, just tificers endeavour to mislead cu- ters in our manufactories. The method is in my opinion the true

nodel of the instrument is forged pper or brass. To this model is ctly *all the desired forms*, by *e face of the hammer penetrate s on the two surfaces*, so as to form that continuity of spherical hollows and salient parts we see upon cymbals, and especially gongs. When the model is finished it is employed to make a mould in sand, in putty, or in metal. An alloy of eighty parts pure copper, and twenty of fine tin, is prepared, which is run into an ingot; it is then re-cast, and run into the mould. The piece when taken out of the mould is rough-scraped; it is tempered as is done with steel. If it is mis shapen, by plunging it red hot into cold water, the shape may be rectified by the hammer, and by flattening it with gentle blows. The required tone may be given either at first by forcing the temper more or less, or afterwards by hammering. It is polished by means of a lathe, as is done with saucepans of copper or brass, and the instrument is finished."—*Asiatic Journal.*

NEW APPARATUS FOR RAISING SUNKEN VESSELS.

Sir,—I have invented an apparatus for raising sunken vessels, which I believe to be different from any yet known, and have made a model thereof. From the trials which have been made, it appears that the apparatus would be exceedingly manageable. It would possess great buoyant powers, and be easily connected to the sunken vessels; the operation could be uninterruptedly continued during the ebbing and flowing of the tides; and the sunken vessel could be raised from any depth to which a diving-bell can, with safety to the lives ot the men inside, be lowered. Two or three would suffice for the whole kingdom, and would cost about 1,000*l*. each.

I am sorry to say that I have not myself the means of carrying this plan into execution; neither am I acquainted with any influential persons who might take it under their patronage. I address, therefore, this notice to you, in the hope that, if you will favour it with a corner in your valuable Journal, it may catch the eye of some gentleman who would be disposed, for a share in the profits of the invention, to assist in bringing it into public notice. I am, Sir,

Yours most obediently,

A. B.

London, July 3, 1834.

[Any letter for the writer, addressed to the care of the publisher of the Mechanics' Magazine, will be duly forwarded.]

NOTES AND NOTICES.

A Parliamentary Committee has been appointed to investigate the claims of Mr. Goldsworthy Gurney to a reward from the nation, for his efforts to introduce steam-carriages on common roads. It may now, therefore, be expected that "the whole truth," with respect to Sir Charles Dance's famous experiment on the Gloucester and Cheltenham road, will at length come out. It will be remem-

... rrary, not ...
... cent, indeed, Sir William
... was taken in tow by a steamer.

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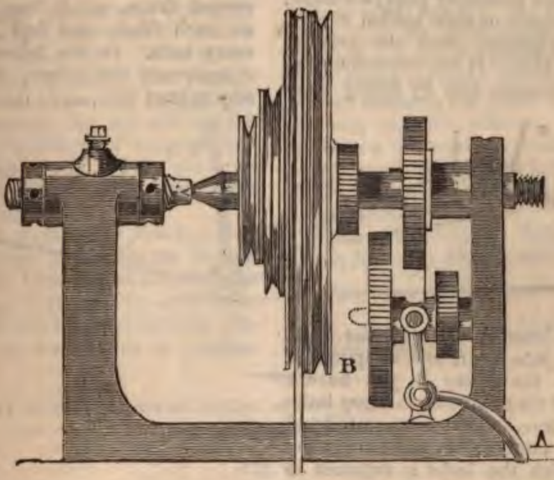
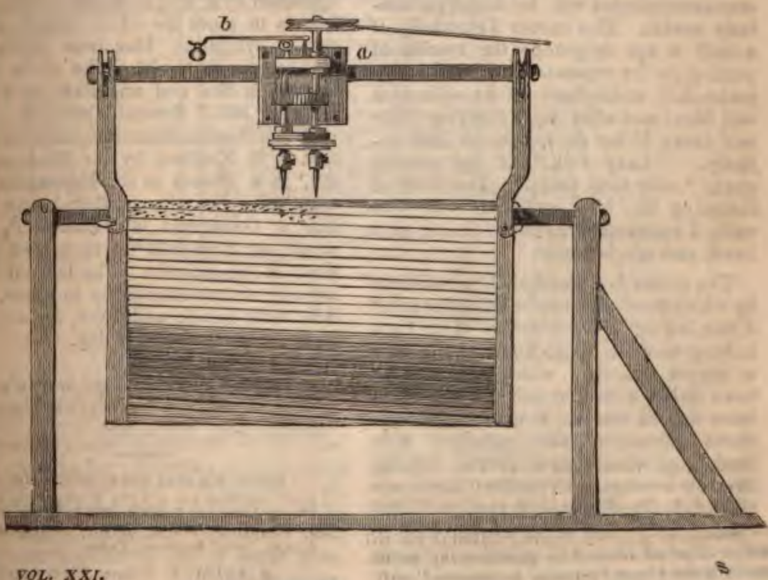
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 571. SATURDAY, JULY 19, 1834. Price 3*d*.

REED'S IMPROVED LATHE.



REED'S DRILLING MACHINE.

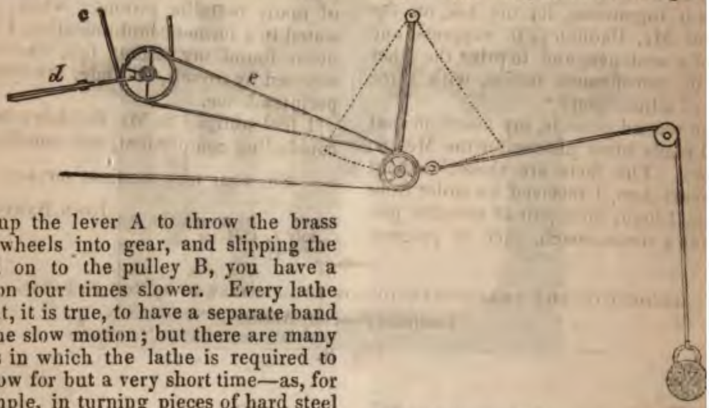


IMPROVED LATHE AND DRILLING MACHINE.

Dear Sir,—I send you herewith drawings of two machines of my invention, for which I may safely claim the merit of great utility, be their pretensions in other respects what they may.

The *first* (see preceding page) is a lathe, by which a quick or slow motion can be alternately obtained with the greatest celerity and ease. It has two pulleys of the same diameter, and by simply moving up the lever A to throw the brass cog wheels into gear, and slipping the band on to the pulley B, you have a motion four times slower. Every lathe ought, it is true, to have a separate band for the slow motion; but there are many cases in which the lathe is required to go slow for but a very short time—as, for example, in turning pieces of hard steel or cast iron—and in such cases the present arrangement will be found particularly useful. The turner (especially if a lad) is apt to grudge the trouble of putting on the separate band, and in his make-shift endeavours to do without it will blunt tool after tool, thinking himself lucky if he do not break one entirely. "Lazy folk," as the proverb goes, "take most pains." The mode of fastening the back cylinder with two nuts, I recommend as better than a cock head, and much neater.

The *second* is a small drilling machine, by which four holes may be drilled at once. I was led to the construction of it from having to drill above 10,000 holes into a copper cylinder, which would have been rather a tedious job had the holes been drilled one at a time. The machine consists of four spindles, with brass cog wheels upon them, working into each other. Of course there are two right-handed movements, and two *left-handed.* The drills are ground to *suit. One of the drill* spindles is longer *than the rest,* and carries a grooved pulley for turning all the four drills. [The] frame *a* (see engraving) is like a [slide] lathe slide tool, having a lever [to] press it down: a small weight i[s suffi]cient for this purpose. The b[ar on] which the drill-slide works, has [a] screw, and is divided into inches; [there] are also set screws to fix it o[n the] copper drum, which was a quar[ter of] an inch thick, and had five ho[les in] every inch. In the following dia[gram] *c* represents the driver, *d* the le[ver to] stop or start with, and *e* the cat-gut



running over pulleys on a swing [frame] tightened by a weight, to allow the [drill] frames to move the whole length [of the] copper cylinder. One man drill[ed it] in about a fortnight. The drills [are] turned on the end and fixed in w[ith a] pin, after Mr. J. Bramah's method.

When this machine was done wi[th, I] sent it to England by our blacksm[ith's] son, as a present to the Mechanics[' In]stitution; but the Custom-house [offi]cers at Gravesend laid hold of it, [and] would not deliver it up except on [pay]ment of two guineas. The lad not [hav]ing any of that commodity to spare, [left] it in their hands, and there, for au[ght I] know, it remains to this day.

I am, dear Sir,

Your obedient servant,

WILLIAM REE[...]

Peterhoff Mills, April 4, 1834.

BARTON'S METALLIC PISTONS.

Sir,—I will be very brief in rep[ly to] Mr. Baddeley's last letter. There [are] only three points to which I am c[alled] upon to allude.

The first consists in the following passage:—"The most extraordinary part, however, of Mr. Barton's letter, is where he denies that there is any improvement in Messrs. Heatons' contrivance; and yet in the same breath claims for himself the merit of the same." Now, my words were,—"That *if* there be any improvement upon my patent (which, by the way, I deny), I am myself the author of that improvement, &c." What inconsistency is there in this? The passage proceeds entirely upon an hypothesis. But is it ingenuous, let me ask, on the part of Mr. Baddeley, to suppress one half of a sentence, and to print the other half in conspicuous italics, with three notes of admiration?

The second point is, my assertion that I had made some pistons for the Messrs. Heaton. The facts are these:—About two years ago, I received an order from Messrs. Lloyd, for a pair of metallic pistons for a steam-coach, then in progress at Birmingham, and which, I was given to understand, were intended for Messrs. Heaton. I now find, by the statement of the latter gentleman, that, in this respect, I was misinformed.

The third and last point relates to the spiral springs. I have used the circular shifting hoop for more than eight years; but the spiral springs I never use, except when they are particularly ordered, as they are not to be depended upon. Indeed, I may say, that they have been, in a great measure, the cause of the failure of many metallic pistons; while, as I stated in a former communication, I have never found my pistons fail, when constructed by myself, or under my own superintendence.

I feel obliged to Mr. Baddeley for his concluding compliment, and remain,

Sir, your very obedient servant,

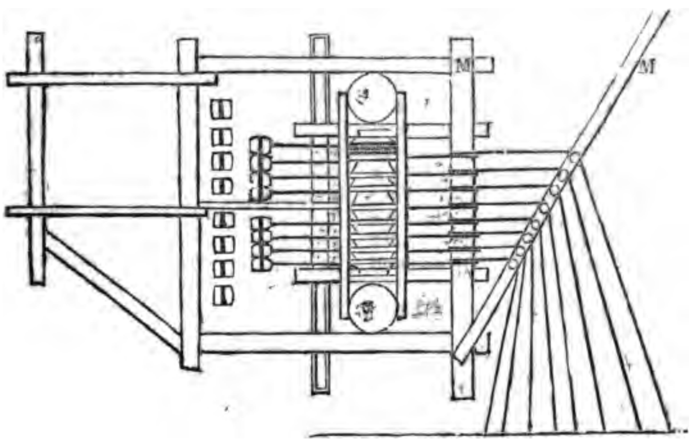
JOHN BARTON.

July 7, 1834.

ACCOUNT OF THE TRANSPORTATION OF THE OBELISK OF LUXOR TO PARIS.

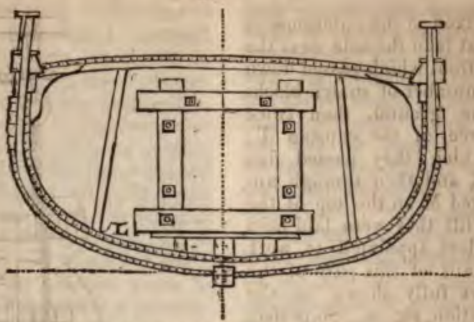
Concluded from last Number.

Fig. 8.



Lieutenant Verniac, the commander of the expedition, anchored the Luxor as near as he could to the site of the obelisk about to be removed, with her head turned from the land. When she had, by the subsiding of the waters of the Nile, settled down in the sand, more *sand was heaped up all around* her to *the height of several feet,* in order that she might be kept perfectly steady in an erect position. She was then dismasted and completely emptied. The next thing done was to cut away the stern of the vessel, to form an aperture through which the obelisk might be conveyed directly upon the keelson. This was done simply by sawing, and the portion cut away, hoisted up by means of shears.

Fig. 9.



A inclined plane was afterwards formed from the temple of Luxor to the ship, running parallel to the two obelisks; for the construction of which plane no less than 362 metres (nearly 10,000 cubic feet) of earth were required. Then to protect the obelisk from being damaged, while drawn along this inclined plane, as well as during its voyage to France, and subsequent disembarkation, it was enveloped from the base to the summit in a casing of planks three inches in thickness, securely fastened together by means of cross bars and bolts. One of the faces of this casing—that, namely, which was to come next the ground on the lowering of the obelisk—was worked perfectly smooth, and also well greased, in order that the friction might be diminished as much as possible.

In fig. 1, of the accompanying engravings, the reader is presented with a vertical representation of the obelisks *in situ*, and the arrangements made on the present occasion for lowering and removing the one on the right-hand side.

Fig. 2 is a continuation of the same.

Fig. 3 a ground plan in two parts; the lower part commencing at E, being the extension to its termination of the apparatus represented in the upper.

A O is the obelisk, with its casing or jacket on.

N, *b*, is a platform, consisting of four stout logs of wood, imbedded in the sand to the depth of the solid earth, and firmly fixed there by eighteen vertical piles driven through them; it occupied a position exactly parallel to the obelisk, but at a distance of several feet from its base. Along the top of this platform ran a beam of wood, which served as the immediate support to eight strong poles, four at each end, which reached a little higher than the obelisk. These poles were of a semi-hoop form at their lower extremities, and turned on the supporting beam, which was rounded for the purpose on its three upper faces.

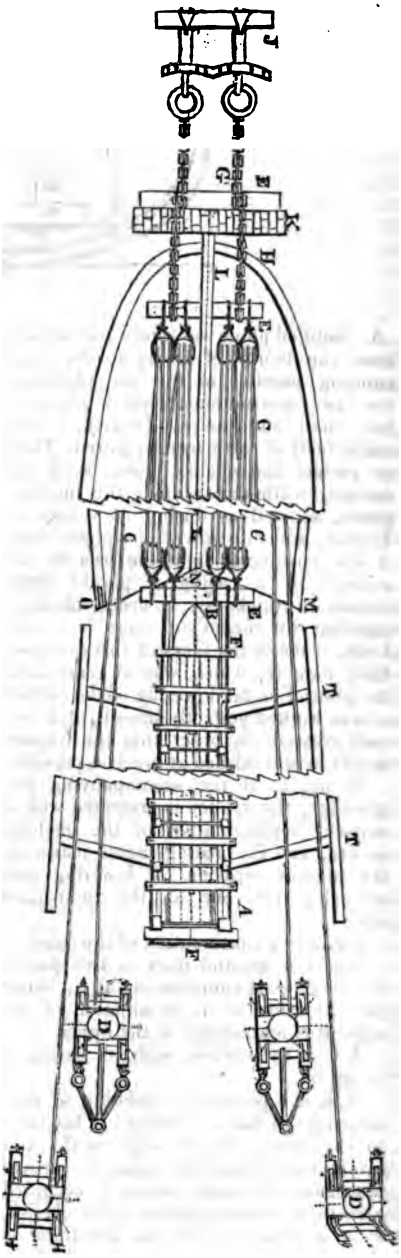
D D are two auxiliary platforms (*systêmes de pièces de bois*), much smaller and slighter than the first, which were placed in front of it, and connected with it by eight planks placed obliquely, each plank abutting against the foot of one of the poles.

H H are shrouds which connected the masts with the top of the obelisk; and E F a large cable, which passed from the top of the obelisk to the anchors (L) fixed in the ground, at the extremity of the inclined plane (Z Z). The earth having been cleared away all around the obelisk, two strong walls of brick were erected one on each side (see fig. 1). That on the right hand side served as a retaining wall to the inclined plane at its summit, and also as a pivot on which to poise the obelisk, while in the act of being lowered upon the trucks F. The one to the left sustained the trunk of a mast (M), by means of which the lowering of the obelisk was regulated, as afterwards explained. An iron chain (C C) was carried from this mast round the base of the column, in order to give greater stability to the former.

T is a capstan, the axletree of which is exhibited on a large scale in fig. 7.

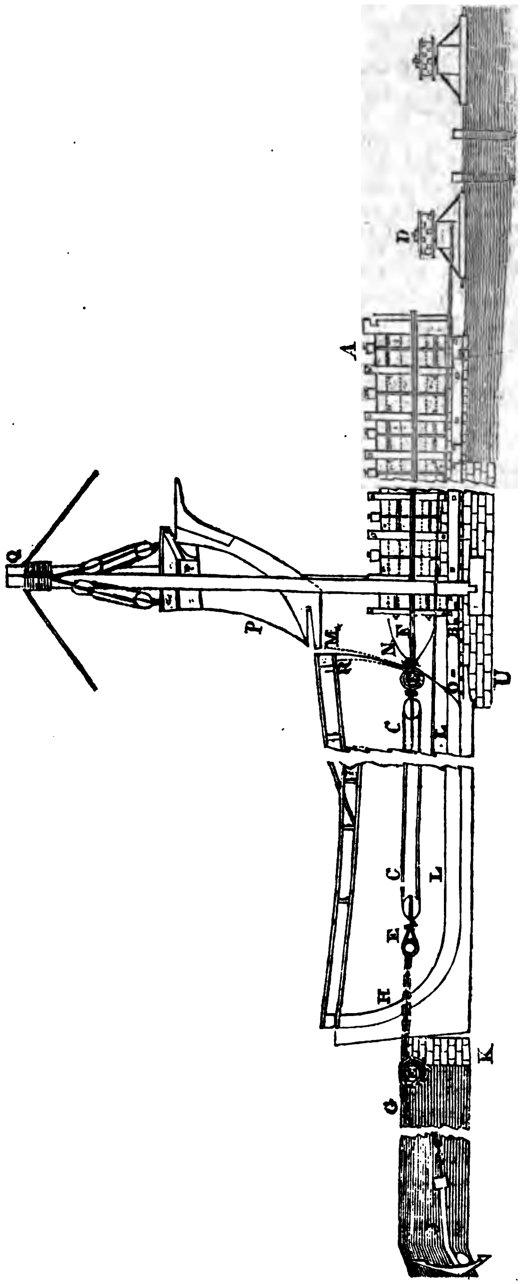
R R, *g g*, represent an arrangement for checking the descent of the column, shown on a larger scale in the elevation fig. 4. The heads of the eight poles were bound together by two thick planks, one on each side. Eight strong blocks

Fig. 10.



or pulleys were fixed in the outermost of these planks, that is in the side next the trucks F, ropes from which passed down through a like number of snatch blocks fastened to the ground, then twice round the axletree of the capstan T; issuing from which they passed first round one mast, and then through another (that marked M on the top of the left-hand wall), till they were laid hold of by eight sailors appointed to work them. The details of this part of the arrangements are fully shown in the horizontal projection, fig. 8. So perfect was this combination of levers, that eight sailors, each holding by one rope, were sufficient to keep in a state of steady oscillation the eight poles which sustained the weight of the obelisk. How they did this has now to be a little more particularly described. Round the top of the pyramid—about 3 feet from the base of the pyramidion, or capital, which is itself 4½ feet in height—the shrouds H, eight in number, were passed crosswise (*en cravates croisées*), and made fast to the cross-beams which bound the eight poles together at top. The resistance which these eight shrouds, thus disposed, presented, was very considerable; and there was need, for they had not only to support the whole weight of the obelisk in its descent, but also the strain from the lowering cable E F. This cable went round the head of the obelisk, immediately above the retaining shrouds H, and terminated in a large triangular loop of rope lined with wood, to which were attached three large pulleys, connected by other pulleys with the anchors L L. It was by the working of this system of pulleys that the lowering cable E was tightened, by which tightening the obelisk was tilted over, and the poles made to rotate on their beam-ends. The ropes of the three principal pulleys were worked by three capstans C C C; the central of which capstans was fixed in the direct line of the inclined plane, with one of the two others, at a little distance on each side. (See the lower portion of fig. 3, where, however, only two of these capstans are shown.) The anchors (L L) were not only deeply sunk in the ground, but secured by stakes, *masonry, and heavy weights, and formed thus a most efficient point*

Fig. 11.

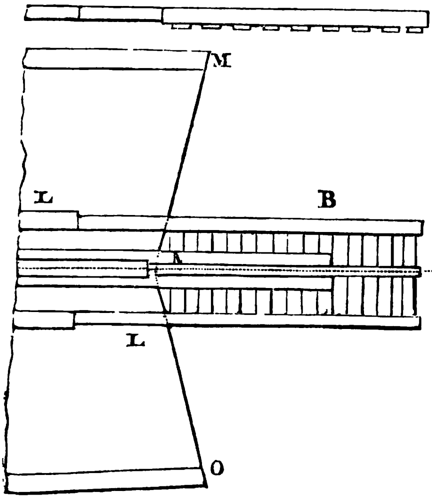


d'appui to the lowering part of the apparatus.

On the opposite side, that is, on the side of the retaining apparatus R R, a *point d'appui*, of equal efficiency, was obtained in a much simpler and easier manner, by the engineer's availing himself of the base of the companion obelisk, in the manner represented at *g g*, figs. 1 and 3. All that now remained to be done in the way of preparation was to insert a block of oak, of a convex form at top, under the bottom of the wooden casing, on its smooth side, to serve as a sort of hinge on which the obelisk might turn in the course of its descent.

To bring matters thus far, took three months and a half of constant labour and fatigue. Every thing being at last ready for lowering the obelisk, the cap-

Fig. 12.



stans, by which the lowering cable E F was to be worked, as well as the pulleys R R, by which the descent of the obelisk was to be checked and regulated, were fully manned, and the operation begun. In twenty-five minutes the obelisk had gained the position denoted by the dotted lines in fig. 1; it rested on the dwarf wall erected towards the right, forming an angle of about 20 degrees with the inclined plane. The whole apparatus creaked *under the efforts of the two contending forces, but* nothing gave way. It became now necessary to poise the obelisk with great exactness on the wall which supported it, in order that it might be carried forward without slipping upon the trucks or trestles F. From the 31st Oct. to the 18th Nov. was occupied in this oscillatory process. Behold the monument at length safely deposited on the carriages destined to convey it on board. The face of the casing next the trucks had, as already mentioned, been well greased; so also were the trucks themselves, that every facility might be given to the passage of the immense load with which they were burdened, weighing, as it did, not less than 250,000 kil. (547,125 lbs. English, avoird.). These trucks were four in number, each composed (see fig. 5) of a solid plank, crossed by strong and well-secured girders, along which the obelisk slid. As soon as it had passed over one of them, that one was removed to the front, and so on successively. The distance which it had to travel down the inclined plane was 372 metres (about 1,500 English feet), and it took a month to accomplish the task, although the men laboured at it for fifteen hours a day. On the 19th of Dec. the head of the pyramid had arrived at the opening made for it in the ship. To understand the method adopted to introduce it on board, reference must be had to the engravings, figs. 9, 10, 11, 12.

Fig. 9 is a section of the ship, near the bow, but with the immaterial parts of the interior hold omitted. Fig. 10, horizontal projection of the apparatus employed to embark the obelisk. Fig. 11, a section through the longitudinal plane of the ship. Fig. 12, a horizontal and vertical projection, which shows how the trucks were brought into the same line with the keelson of the vessel.

In these four last figures: B represents the trucks; C the traction apparatus; D, capstans; E, cylinders to which the traction pulleys were fixed; F, a strong cable, which connected the obelisk with one of the cylinders E; G, two iron chains, which passed round the cylinder E; H, two holes made in the front of the vessel, to afford a passage to the chains G; J J, anchors sunk in the ground at a little distance from the ship, and firmly secured there by weights and stakes—to which anchors the chains G were fastened; K, a stone wall, constructed to prevent the chains from rub-

bing against the ship; L, the keelson of the ship; N N O, the aperture made for the admission of the obelisk; P, the piece which was cut away; Q, the sheers which kept that piece suspended; T, props placed on each side of the obelisk to keep it in its proper position; U, abutment in front of the keel, constructed of stones and soft earth.

These preparations for embarking the obelisk being all completed, the men were again set to work at the different capstans, and in two hours it was safely deposited on the keelson of the Luxor. From the 19th to the 25th of December was occupied in restoring the bow of the vessel to its place. She was then masted and rigged anew, disengaged from the sand in which she was embedded, and proceeded down the Nile on her way back to France.

A view of the base of the obelisk is given at fig. 6. A slight fracture runs quite across it from V to V. To prevent it from increasing, two double-dovetailed tenons were inserted at the points X X.

W. A. R.

RECENT AMERICAN PATENTS.

[Selected from the Franklin Journal.]

Improved Wheel for Locomotive Cars and Engines. *Ross Winans, C. E.*—The more clearly to exhibit the difference between this wheel and those which have been heretofore employed, it may be proper to point out the manner in which wheels for this purpose have been most commonly made.

1st. Such wheels have been made wholly, or nearly so, of cast iron; the face or tread of them being cast within a *chill*, consisting of a thick rim, or hoop, of iron, which forms a part of the mould. 2d. The wheels have been cast without being chilled, and afterwards hooped with wrought iron, which then forms the face and flanch of the wheel. 3d. A cast iron nave or hub, has been made to receive wooden spokes, inserted in wooden felloes, which were hooped with a tire of wrought iron. 4th. The hubs have been of cast iron, with spokes of wrought iron, and a rim of wrought or of cast iron, hooped with wrought iron. These plans have each their respective advantages and disadvantages, but neither of them has fully answered the purpose for which it has been adopted; the wrought iron hoop, or tire, upon the cast iron rims, have gradually become loosened; the *wooden spokes* and *felloes* have pressed the *one into the other*, and the tire has ceased to bind them, an evil which wedging will not cure. To remedy these defects, and others incident to some of the wheels, is the object of the present improvement. Mr. Winan's new wheel consists essentially of three parts, namely, an *interior wheel*, the hub, spokes, and rim of which are of cast iron; a *rim of wood*, formed in a way to be presently described, surrounding the cast iron wheel; a *hoop, or tire, of wrought iron*, surrounding the wood, and forming the face or tread of the wheel. *The inner wheel* is made, in some respects, like those first noticed, but the face is not chilled, nor has it the same form with the chilled face. It should be made of the same width on the rim with the wrought iron tire which is to surround and form the tread of the wheel, say five inches. The face of the cast rim may be cylindrical for the greater part of its width, but it must in this case have a fillet, or edge, projecting up on each side of it, say to the height and of the thickness of half an inch, which will then give to it the appearance of a wheel with a double flanch, having a cylindrical tread of four inches in width. Instead of making the face in this form, the patentee proposes sometimes to give to it a regular declination from each edge towards the centre. A section of the rim, transversely, would then be somewhat in the form of the letter V, but with the angle obtuse. The inclination will be sufficient if the diameter at the centre of the rim is one inch less than at the sides or edges. Other forms may be given to the face of the rim, by which the object in view may be attained, namely, that of retaining the wooden rim in its place, without its allowing it to move out on either side. A *rim of wood* is to be placed around this wheel, which may consist of any convenient number of pieces, fitted to each other and to the face of the wheel. The grain of the wood is to cross the rim of the wheel, running parallel with its axis. These pieces may be fitted to the face of the wheel with great facility, by driving them into a large hoop, running as a chuck in a lathe, by which means they may be turned to the form required; they may then be fastened on to the rim by wood screws, or otherwise, and turned thereon to receive the iron hoop or tire. The best thickness of this rim will be from two to four inches. The *hoop, or tire, of wrought iron*, is to be made in the usual form, turned truly, and passed on over the wooden rim when expanded by heating it as highly as may be done without burning the wood. Bolts are then to be passed through the wrought iron, the wood, and the cast iron rims, which are secured by nuts, to confine the whole together.

The hub, or nave, in a wheel thus made, may be cast entire, instead of having these

or openings which are necessary in d wheel, to allow for contraction. readily perceived that the wood, ed between two hoops of iron, has of bearing surface which will effprevent its being condensed by the which it is subjected; whilst, by its it will tend to preserve both the the vehicles passing over it. If dried when put on, which may be artificial heat, the wood will never ut, on the contrary, will expand, r all the parts the more firm. Such will have less tendency than any ere wood is employed, to get out of d should wedging become necessary, e done more effectually than with . The dimensions of most of the uch a wheel need not differ greatly e of the cast iron wheels with chilled , like them, must vary according liameter, and the load they are to the following is a good proportion s of three feet in diameter; inr cars carrying threee tons:—Cast rior wheel, twenty-nine inches diaub seven inches long by six in diaokes, twelve in number, five-eighths ch thick, and three and a half or es broad; rim five inches broad by hs of an inch thick; wooden rim ive-eighths inches thick, five inches asuring across the rim; wrought even eighths of an inch thick, five oad; flanch one and one-fourth one inch thick.

ONING MACHINE. *Henry Mellish.* on wheels, or disks, are fixed upon shaft, made to revolve by a band ound a pulley; the iron disks are a distance from each other exceedf the thickness of the tenon to be on the peripheries of the wheels are isels or cutters; and the pieces of be tenoned are secured by proper ces, upon a sliding carriage, so tuff can be brought up against the cutters, which leave the tenon of thickness, and properly shouldered, has passed through the revolving

COMPARATIVE VALUE AND IMNCE OF MATHEMATICAL SCIENCE, N THE PRETENSIONS OF ITS PROs.

Whilst occupied in writing a reinclaven, I was led to indulge in servations on the intellectual nd practical value which ought igned to mathematical acquire*nd on the overweening* pretensions of some of the mathematicians; but these remarks became so much extended under my hand, that I have thought it best to give them to you under another form. I am, Sir,

Yours respectfully,
BENJ. CHEVERTON.

Men's minds appear to be differently constituted in regard to the investigation of things. Whilst the generality take a view of a subject merely as a particular case, and reason upon and examine it only as connected with its more immediate causes and consequences, the profound inquirer analyses it, to discover the law or principle which pervades it in common with many others; to trace and connect it with those of dissimilar aspect; to show that in the abstract they belong to one common truth, though in the concrete, or in their actual existence, produced by the modifying agencies of their peculiar circumstances, they present appearances which apparently have no relation to each other. Such are the minds who have for their high aim the extension of the principles of knowledge; but though peculiarly fitted for discovery, they are not the best qualified to bring science down to practical application, or even to make it literally accord with matter of fact. In disentangling the complications resulting from concomitant agencies, they are so intent on arriving at the most general truths, so systematically disregardful of the separate consideration of those agencies, and so much in the habit of keeping the analysis disencumbered of all ideas not comprised in the upward leading train, that when, by a course of synthetical reasoning, they would turn their discovered principles to account, and build up a system on their foundation, they too much exclude the operation of the subordinate laws which concur in influencing, and more immediately regulate, the ultimate result, and which give to things the form and appearance which they present. Their conclusions, though correctly drawn are true only in part, and by assumption and limitation, true mentally, but not materially, or as found in actual existence.

But there is another class of minds of nearly the same stamp and mould as the former, who, though not taking the like

characters with which mathematical operations are conducted, and whose results, though only abstractions, are too often confounded and identified with realities, are not only the mere symbols of things, but the symbols merely of one or two qualities in things; and, therefore, though the conclusions are true, rigorously true as to the signs, they are false as to the things themselves, when regarded in their ultimate modified results, from the influence of those qualities or accidents which the mathematician does not or cannot symbolise—which he does not, because the complication arising from their reciprocal actions exceeds and defies his means—which he cannot, because in regard to some of them, there is not sufficient analogy in the types to warrant the deductions they afford being transferred to the archetypes. Even as to those said qualities (extension and intensity) which form the subject matter of mathematics, the investigation is then limited, and therefore imperfect, from the impossibility of extending the analysis to all the ramifications which branch forth from it. The mathematician arrives at the truth, and nothing but the truth, but not at the whole truth—not even at the whole of the only kind of truth which symbols give. When, however, the case is so simple that the investigation comprehends all the possible relations belonging to those qualities, and the only result sought for in things is a knowledge of those relations, then it may be said, and only then, that the conclusions of the science are not only indubitable, but identical with realities—but what does not this limitation exclude?

The mathematician has a little, a very little world of his own, in which every thing is in the utmost order, subject to known laws, involving definite and foreseen action, liable to no interference not calculated on and provided for, and the whole capable of coming within his own powers to regulate and govern according to assigned rules; for things which can not be made amenable to his jurisdiction are ejected from his domain. He therefore admits nothing of unknown power or which may exert an influence, which he cannot see, and introduce uncertainty and casualty within his precincts. Hence, also, many agencies, though well understood, are rejected by him, lest they should prove too numerous for his perfect

cognisance, and lest more subordinate laws should obtain than he can see and understand their bearings; or else he accepts only the first modifications which they may produce, and then casts them out altogether, whereby he avoids the many puzzling anomalies and exceptions which would proceed from their mutual actions. Hence, also, he ejects, as they arise, whatever among the collateral effects may complicate and embarrass the more direct train of results. Thus he sees and comprehends every thing, the whole is within his grasp, demonstration attends him at every step, aberrations are impossible, contingencies are out of the question, all results are naked to his sight, and his prescience embraces all, because his knowledge is certain and perfect, and extends to all. But, on the other hand, this is a world of curtailment and exclusion, in which nature is deprived of her just proportions, and of many of her endowments—it is a world of meagre forms and distorted shapes; and thus feeble man, failing to stretch his powers to a comprehension of the full length and breadth and depth of things, makes the things themselves conform to the extent of his own puny faculties, and then, in all the self-sufficiency of pride, exclaims, —behold! this is nature!*

When the mathematician comes forth from this tiny world of his into the world of realities, he is bewildered with the multiplicity of its objects, he is confounded with the immensity of their relations and mutual aspects. He looks for certainty, and can scarcely find probability. Accustomed to demonstrate, he is unqualified to estimate; and in the habit of concentrating his attention to a single, unbroken, unerring, and necessary chain of inferences, and having the power permanently to record its every link, and fix the otherwise fleeting convictions of certainty, he is unfitted to retain a steady and expansive view of several collateral lines of action, to balance conflicting influences, to adjust their proportions, and from the whole to educe the nearest to the true conclusion which only actual results can make to appear. Emerging from his world of abstract ideas, if indeed it be so much as this, he finds the real world, and the things thereof, to be a perfect enigma. He can follow, it may be, in the tract of those who have unravelled it a little; but he has no powers of himself to unravel it further. Desirous, however, of doing something, though it may be only after his own method, suiting, therefore, the subject to his means and habits, he seizes a few of the most manageable facts; and if they are not to him already isolated, by his ignorance of the ties by which they with all things are bound together, he takes care to sever their connexion with disturbing causes, and to rid himself of all embarrassing extraneous influences. If his facts are not sufficiently fruitful of principles, he can eke out his case with a few postulates; and, if they are untractable, he can frame an hypothesis which shall present, as nearly as possible, the same appearances. He then proceeds, in the most lucid and masterly manner, to build his system scientifically. All its parts are in harmony, all its conclusions are demonstrable. His penchant for clearness, order, and certainty is gratified, and he fondly flatters himself that the results which he brings forth are conformable to nature. He does not consider that the harmony and clearness which he so much admires, gives every reason to suspect that he is entirely wrong; for the one may arise from every element of discord being rejected, and the other from those narrow and contracted views, which, by reason of our limited faculties, we are only able to take when absolute certainty is to be the result. Professor Sedgwick, whose scientific pursuits tend to enlarge and expand the mind, has a just observation in a recent publication of his, which, though having an immediate application to one particular subject, is by no means foreign to the tenor of the present remarks:—"To suppose that we can reason up to a First Cause in moral questions—that we can reach some simple principle, whence we can descend with logical precision to all the complicated duties of a social being, is to misapprehend the nature of our faculties, and utterly mistake the relation we bear both to God and man. Such a system may delight by its clearness, and flatter our pride, because it appears to

* The arrogance of some of the naturalists is astonishing. They sit in judgement on nature, criticise her works, and talk of the attempts in which she has failed to perfect her plan. After all that has been said of the inductive philosophy, and of our being the humble disciples of nature, the race of the king of Castile is not yet extinct.

bring all our duties within our narrow grasp; *but it is clear only because it is shallow, while a better system may seem darker only because it is more profound.*" Thus the mere mathematician is disqualified by his prejudices, his habits, and the tutored bias of his mind, to look at the world of nature as it is. For, however paradoxical it may appear, views may be taken of it which though less exact than his may be more complete, and though less certain may be more probable. He is really better qualified to comprehend an entire system of worlds, so far as it may be explored by others possessed of a superior order of intellectual gifts—for the only point of view in which he can regard them, is merely as individual entities, whose dependence on each other is governed by one universal law of influence, and whose aberrations and disturbances, therefore, are not in the main beyond his scope. But, in respect to mundane affairs, he has not the *coup-d'œil*, the tact, or the *intuitive* perception, as it appears to be—though it is not that, nor is it innate, except so far as natural aptitude is concerned; but it is a deliberate process, and an acquirement derived from long habituated reaches of comprehensive thought, and faculties well disciplined by suitable practice—he has not, I say, that fine *eventual* perception, as it may with more propriety be called, which includes the whole implication of things, their mutual actions, and their final issue, whereby others are enabled to combine vastly, if not minutely, to establish something like order and gradation in the gross, if not in the detail; to foresee with a degree of certainty, though it may be with some obscurity; and to catch the shadows, if not the lineaments, of unknown forms. Such powers in any perfection are not often combined with high mathematical attributes, for they are of diverse tendency; but when they are united and directed with a combined effort to connect systematically the wide survey with first principles, they mark not only the true but the pre-eminent philosopher. Such was Newton. In his profound inquiries into the phenomena of nature, requiring new methods of mathematical investigation, his merits in that respect are, no doubt, eminently conspicuous; but yet, *as the founder of a system*, it is not so much the mathematician as the philosopher which shines forth in him. What a contrast there is between him and Descartes. With what sagacity he brought to light slight and hidden analogies, and what wisdom is displayed even in his scholia and his queries. His very conjectures partake of the nature of science. How extraordinary was that concerning the diamond; and who can say that his idea concerning the cause of gravitation may not yet be verified, or at least rendered highly probable.

The tendency of mathematical studies to unfit the mathematician for the general study of nature, and for investigation into the complex structure of human affairs, has now been stated—in very general terms confessedly, but that of course was unavoidable, unless there was an intention to write a complete dissertation on the subject. There is, however, another cause which lies at the root of that unfitness, peculiar to the mere mathematician. It consists in the very structure of his mind, that is, in the inequality of his faculties. "In almost all the instances of mental superiority," says Dr. Chalmers, "it will be found that it is a superiority above the average level of the species in but one thing—or that arises from the predominance of one faculty above all the rest." We may extend this remark, and say that nature is seldom perfect in opposite directions in the same individual, and that if her bounty flows strongly in any particular channel, it is generally at the *expense* of the diverging streams. This is so remarkably the case in regard to the mathematician, that deficiency in judgment is proverbially ascribed to him. Now judgment, in a popular sense, is a collective word for the several faculties which concern not the abstract ideas, but the realities of things in their actual forms. Thus both the congenital deficiency and the predisposition, mutually concur with the habit which they produce to make the mere mathematician what he is—utterly unqualified to investigate any thing out of his own province. But properly to establish the point of his *natural* inaptitude would lead me too far into metaphysical, and, as some would think, into phrenological disquisitions.

Nature may, in some instances, bestow her gifts with as balanced as a bounteous hand; but then the study of

mathematics, in all its fulness, is so engrossing, demanding so large a portion of time, as to preclude the generality of its students from the acquirement of that extensive knowledge of things and their relations, which is necessary to furnish the philosophic mind. "Mathematics," says Duncan in his Logic, "is an engaging study; and men who apply themselves that way so wholly plunge into it, that they are, for the most part, but little acquainted with other branches of knowledge. Even such as are alleged to have excelled in their own profession, and to have discovered themselves perfect masters of the art of reasoning, have not always been happy in treating upon other subjects; but rather fallen short, not only of what might naturally have been expected from them, but of many writers much less exercised in the rules of argumentation. Because, however perfect they may be in the art of reasoning, yet wanting here those intermediate ideas, which are necessary to furnish out a due train of propositions, all their skill and ability fails them; for a bare knowledge of the rules are not sufficient, we must further have materials whereunto to apply them."

Barbeyrac, in the preface to his translation of Grotius, "De Jure Belli et Pacis," informs us, says Kirwan, that a mathematician undertook to refute it; but of this refutation he says, "on n'a jamais rien vu de plus pitoyable, et on seroit surpris qu'un mathematicien pût si mal raisonner, si l'on n'avoit d'autres exemples bien plus illustres, qui montrent clairment que l'etude des mathematiques, ne rend pas toujours l'esprit plus juste en matiere des choses qui sont hors de la sphere de ces sciences." And Condillac, according to the same author, says, "nous avons quatre metaphysiciens celebres, Descartes, Malbranche, Leibnitz, et Locke; le dernier et le seul, qui ne fut pas geometre, et de combien n'est il pas superieur aux trois autres?"

It cannot, however, be denied that a few mathematicians have been philosophers; or, rather, that some philosophers have also been mathematicians. Men possessed of an equilibrium of the faculties, and endowed with sufficient energy to sustain and invigorate them all—men of panoramic as well as of microscopic *vision—men who extend* their views beyond the mere rules, the elegant abridgments, and the ingenious artifices of the science, and who, valuing them only as means to a nobler end, merge the powers of the analyst in subservience to the grand objects of philosophy. It is from men like these that the mere mathematician has received a reflected lustre, and a consideration which is not his due. But the far greater number of philosophers, and the most useful ones too, have *not* been mathematicians. To instance only in our own time, and without adverting to living characters—having regard only to one branch of physical science, that which concerns the intimate nature and constitution of bodies, and passing by the various other departments of philosophy, such as morals, economics, physiology, geology, and the like, we may mention the names of Priestly, Franklin, Davy, and Wollaston.* It is probable that most of our eminent philosophers may have had some slight general knowledge of the mathematics, such as even our practical men commonly possess, and such as becomes a liberal education. They may have run through Euclid just as they may have run through Homer; nay, they may have done more than this, without being mathematicians any more than they were Grecians. This, in particular, may be said of the last-mentioned philosopher, though I believe so much even cannot be affirmed of the others. Even among our engineers, whose pursuits would seem to make mathematical acquirements more requisite, the most eminent such as Smeaton, Watt, Rennie, and Telford, have not been distinguished by any beyond the merest common-place. Many of their compeers have advanced much farther in these routine attainments, and yet wanted that tact, that fine superior sense, which is far more indispensable to the man who has to take and deal with things as they are, enveloped in all their circumstances, and subject to all their qualities and contingencies. Sir John Herschell observes, that "almost all the great combinations of modern mechanism, and many of its refinements, are *creations of pure intellect*, grounding its exertions upon a very *moderate number of elementary propositions* in theoretical mechanics and geometry." In what have the pupils of the

* We have Mr. Babbage's authority in regard t Dr. Wollaston.

Ecole Polytechnique, who are all mathematicians, excelled our own engineers? Let the fate of the first suspension-bridge at Paris tell. We have yet to avail ourselves of the eminent services which the high mathematical attainments of the pupils of our own school of naval architecture were to render to the science—if science yet it be. What has been the result? Does even the surveyor of the navy put forward any scientific pretensions? Has he not been selected out of another profession? Has the professor of the school himself succeeded better, or so well, as the unpretending shipwright who built the Pearl? Let it not, however, be understood, that the school has not sent forth able and useful men, or that they have received rewards equivalent to their merits. But it is maintained that in this, as in many other cases, the tentative method has been, and perhaps ever will be, of more value than science, and that those qualities of the mind for which I have contended, and which science cannot give, are superior to and more indispensable than mathematical attainments; and this may be said without condemning the application of analysis as far as may be, to the successful results which experiments on a large scale may have produced. In such analysis indeed, if sagaciously and not too rigidly and scientifically conducted, those superior qualities will appear, just as they do appear, in the rough empirical sort of analysis which the successful though unpretending shipwright calls to his aid. Those among the students who are in possession of these natural gifts, will break through the prejudices and pedantry which a too engrossing attention to mere science creates, and keeping it in its proper place will make it secondary or subservient to a comprehensive view of their peculiar and very complicated subject, satisfied, if they cannot mark and estimate all the concomitant influences, in a manner so precise and determinate as they could wish, that they at least form their conceptions and draw their conclusions in conformity to the *truth* of things.*

(To be concluded in our next.)

* *Let this be exemplified by an able article which appeared within these few months in the "United Service Journal," written, I believe, by a pupil of the school above mentioned.*

MR. RUSSELL'S STEAM-CARRIAGES.

(From the Edinburgh Observer.)

Through the medium of a letter received from Glasgow, we are happy to record the great and increasing success of these carriages. Our friend writes, that having recommenced their regular business-career on Wednesday morning, they ran throughout the day with the utmost punctuality. The rate of speed may be judged of from the following statement sent us:—

1st Carriage,	No. 4....	30	Minutes.
2d do.	No. 4....	34	do.
3d do.	No. 3....	45	do.
4th do.	No. 3....	46	do.
5th do.	No. 1....	25	do.
6th do.	No. 1....	25	do.

The distance here taken is from Tradeston, Glasgow, to the Tontine Inn, Paisley; for although the carriages start from George's-square, they are of course not put to their speed until they have got clear of the crowded streets; but as this distance is at least seven miles, the rate attained by the last mentioned vehicle, which, we understand, is the one containing the most recent improvements, is not much less than seventeen miles per hour. Another circumstance we are glad to hear was, that so highly have the public in that quarter already begun to appreciate this new mode of conveyance, that the carriages were overloaded with passengers the whole day. We observe, however, that the trustees of the Glasgow and Paisley road are by no means favourable to the undertaking, and have been for this week past busying themselves in laying down immense heaps of stones on all the ascents and *best* portions of the road, for the apparent purpose of obstructing the progress of the carriages, though hitherto without effect. This conduct, as might have been expected, is meeting with the general indignation of the people in that quarter.

(From the Glasgow Courier of July 1.)

We have much pleasure in noticing the last two days' most successful performance of the Glasgow and Paisley steam-carriages. On Wednesday the carriages performed six trips, running every hour from ten till three o'clock, and yesterday an equal number. The carriages were crowded with passengers, and so great was the anxiety to obtain seats, that although there is accommodation for twenty-six, it was found impossible to prevent upwards of thirty persons from taking seats upon them. The average velocity of the carriages is twelve miles an hour, and the only impediment to a high rate lies in the extraordinary state of the road, which should at this moment be in the best possible condition, but has just been deeply bedded with broken stones, laid on in large

for the purpose of injuring the car- This is a line of illiberal policy ; is hoped the trustees will not per- n, as it cannot possibly in any way e success of the carriages, which will y be carried through with advantage, e road is thereby rendered unfit for oses of general traffic, at a great ex- a public trust. At the sixth trip 'ednesday last, and as the steam- was coming up to the new metal, it d that enormous heaps of stones had n laid down; and the tremendous equisite to bear through it smashed the wheels, and detained the carriage s replaced.

(From the Glasgow Herald.)

he evening of Friday last, a highly ng experiment was made upon the road, for the purpose of ascertaining parative merits of two of the com- arriages upon different constructions. after six o'clock the carriages left s-square, with a full supply of fuel ter adequate for eight miles. The s proceeded together through the streets, as rapidly as safety would and along the Paisley road, to a little beyond the two-mile house, they turned and started together. eeping exactly together for about a of a mile, the carriage, on the im- onstruction, began to show a mani- eriority, and rapidly distanced the nd on arriving at the Gorbals, Glas- d gained half a mile, having done le distance in seven and a half , while the latter required ten . The same carriage had, on the Wednesday, done the distance from tine at Paisley to the Gorbals of , being seven miles in thirty-three , including stoppages.

m the Glasgow Courier of July 4.)

Vednesday the steam-carriages com- running every hour, with passengers gage; and they have since been ply- the most triumphant success. The s start from George-square a little the hour, and, proceeding down treet, take up passengers at the foot nd starting from the head of Max- et, they pass through Tradeston, ey again take up passengers. This y occupies about twelve or fifteen ; and the seven miles to Paisley are ne in thirty or thirty-five minutes. inutes are thus left to take in a sup- water and fuel, with the complement engers, at Paisley; and at the suc- hour the same carriage again re- Glasgow.

lso noticed in our publication of *the kindness* with which the road trustees, at the Glasgow end, had accommodated Mr. Russell's carriages at their own expense (or that of the public), with a sufficient quantity of new metal to try their powers; but we have since discovered that this *kindly disposition* has been carried a little too far, and that having found the carriages more than competent to the task of ploughing through the stratum of broken stones, previously laid down, they employed a large number of men, on the following day, to lay down another stratum of equal thickness, on the top of the former, rendering the road scarcely passable to any heavy load.—Finding this expedient also ineffectual, we learnt yesterday that horses and carts and a number of men had been engaged during the whole of the night, in laying down loads of broken stones, to such a depth, that they were obliged to cut away the bottom of the toll-gate, in order to allow it to close over the mass.

The difficulties surmounted in bringing these vehicles to the perfection here indicated, and the qualifications of the inventor, are what scientific persons alone can duly appreciate; and we certainly cannot furnish our readers with a more striking estimate of both than by quoting the following observations, from a very able paper on "the relation between a machine and its model," by Mr. Edward Sang, teacher of mathematics in Edinburgh, and which we find in the Mech. Mag. for January last:—

"At the surface of Jupiter, a steam-engine of 20 horses' power would be unable to move—at the surface of our Earth, one of perhaps 1000 horses' power might perform pretty well; but at the surface of the Moon, they might be made of perhaps 20,000 horses' power—supposing the pressures of the atmospheres in the three cases to be alike. On Jupiter, a steam-carriage would be an absolute chimera; *on the earth it is barely possible;* but on the moon nothing would be more usual. An intensity of gravitation, slightly greater than that which the earth exerts, would altogether preclude the hope of obtaining a locomotive-engine. As it is, on flat rail-roads they perform well; as the road becomes inclined, they become less practicable; *and, on common roads, nothing but the most consummate skill in the selection and in the use of the material, as well as in the contrivance of the parts, can ever be successful in their construction.* Security demands strength, strength requires weight, weight increases the friction, friction calls for additional power, and power can be procured only by an increase of weight. *To reconcile these conflicting claims is not the task for a beginner in mechanical contrivance, but for one well versed alike in the theory and in the practice of the arts.*"

NOTES AND NOTICES.

The House of Commons' Committee on steam communication with India, have reported to the House that, in their opinion, the route by the Euphrates and the Persian Gulf is superior to every other proposed, for its "physical, commercial and political advantages," and they recommend that a grant of 20,000*l.* should be made by Parliament to defray the expense of giving it a fair trial. The distance from Bir in the Persian Gulf, where this line would commence, to Scanderoon in the Mediterranean, is stated to be much less than that between Suez and Alexandria. The Committee do not appear to have inquired at all into the merits of the route by the Cape of Good Hope. We are surprised at this, for whatever may be said in favour of either of the Mediterranean routes, as affording a quick, though not always sure, conveyance for letters, we think it is demonstrable that for goods, passengers, and troops, the line by the Cape is that on which steam may be employed with the greatest advantage. We alluded some time ago to a pamphlet, by the Messrs. Seward, C. E., in which this view of the subject is very ably advocated, and shall take an early opportunity of bringing it again more particularly under the attention of our readers.

The Bengal Steam Fund Committee have advertised, in the Indian papers, that the steamer "Forbes" would start from Kedgeree, for Suez, on the 15th April; so that by this time the letters and passengers ought to have arrived in England. As great dissatisfaction had been excited in the other Presidencies at the preference given to Bengal, something may have occurred to prevent the vessel's setting out at the appointed time. She was to carry only nine passengers:—three from Bengal, and two each from Bombay, Madras, and Ceylon.

M. Dupin has been so well pleased with his reception in England, that one of his colleagues, the Duke de Broglio, is about to follow his example, by paying his respects to the Lord Chancellor. Forthwith, of course, he will be taken to the Mechanics' Institution, and made an honorary member. The distinction will not, however, be so appropriately conferred as it was on M. Dupin, whose brother, Baron Chas. Dupin, is well-known as the introducer of similar institutions into France.

Turkish Mode of Illumination.—Every night the seraglio presented a different figure—a ship, the imperial cypher, the Sultan's ten oared galley, an immense star, a passage from the Koran, &c. These changes were sometimes effected during the same evening. This mode of illumination which is peculiarly Turkish, might well be adopted by Europeans: it is managed as follows:—A frame, from 30 to 40 feet high, is erected in front of the building to be illuminated; on the transverse beam small pulleys are adjusted, through which small lines are passed, to which the lamps are made fast at proper distances, and admit of being raised or lowered with the greatest ease, according to the outline of the figure to be formed. These lines resemble the warp of a web. Great extent can thus be given to the illumination at little cost—the rapidity with which a figure is transformed into another is surprising; in order to facilitate the metamorphosis, every line has marks, indicating the height to which it is to be raised, according to the exhibition intended. Every eminence can be taken advantage of—chimneys, minarets, trees, steeples—and great room for the display of taste in the selection and variety of the figures may thus be obtained.—*From a Correspondent of the Times.*

By the bill for the "Better Regulation of Chimney-sweepers and their Apprentices, and the safer Construction of Chimneys and Flues"—as it has passed the House of Lords—it is proposed to be enacted, that in future all partitions between chimneys or flues shall be of brick or stone, and at least equal to half a brick in thickness—that every breast, back, and partition, shall be built of sound materials, and the joints of the work well filled in with good mortar or cement—that every chimney or flue of greater length than four feet out of any wall, not being a circular chimney or flue of 12 inches in diameter, shall be in every section of the same not less than 14 inches by 9—that no chimney or flue shall be constructed with any angle therein, which shall be less obtuse than an angle of 120°—and that every salient or projecting angle shall be rounded off 4 inches at least: Providing always that nothing in the bill shall prevent chimneys or flues being built at angles with each other of 90° and more, "such chimneys or flues having therein proper doors or openings not less than six inches square." Should the bill, with these enactments, pass into a law, something will certainly be gained to the cause of humanity; but it seems to us, notwithstanding, to be conceived altogether in a very petty spirit of legislation. The shortest, and, at the same time, the only effectual way to put an end to the stifling and burning of infants in chimneys, is to prohibit absolutely and entirely the sweeping of chimneys by infants. Do but that, and people would soon, of their own accord, do all that it is now proposed to compel them to do, by a law, so nice and arbitrary in its provisions, that to enforce it generally and effectually will be impossible.

A curious piece of machinery to measure time has been invented by Mr. Andrew Symington, watchmaker in Kettle. This timepiece is much more simple in its construction than the common eight-day clock, requires only to be wound up once in twelve months, and being quite silent in its movements will be admirably adapted for bedrooms. In this timepiece the pendulum and scapement are done away with, and a simple but efficient substitute is applied to the crown wheel, as in detents, which only allows it to revolve once in an hour, and has quite an uniform motion, without producing the smallest vibration in the machinery. Another important part of the discovery is a particular material for the pivots to move in, which is quite free from any cohesive quality, and requires no oil, therefore avoiding the irregular motion produced by the evaporation of the oil and other causes. Mr. Symington is about to construct a clock on this plan, to be sent to London, for the purpose of being exhibited there.—*Fife Herald.*—The Mr. Symington here mentioned is a son of the late eminent William Symington, the father of modern steam navigation.

Mr. Andrews requests us to state that it was the printer who was in error in representing (page 152) the difference between the scales as amounting to .34, it should have been, as suggested by Mr. Simms, .034. For, 17 links in 50 chains, or $\frac{.17}{50,000} = .034$ of an inch.

Communications received from Columella—D. T. S.—P. L.—ϕ. μ.—Mr. Blackett—E. S. P.

The Supplement to Vol. XX., with a Portrait of William Symington, is now ready, price 6d. also Vol. XX., complete, in boards, price 8s.

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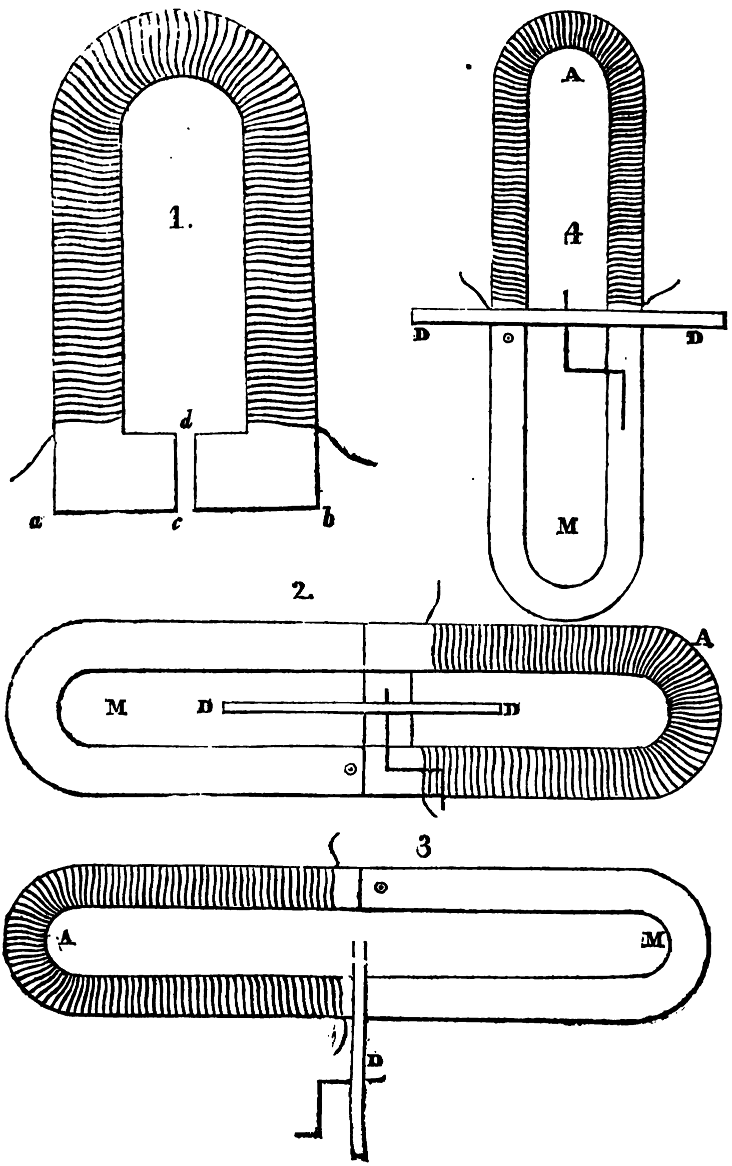
No. 572. SATURDAY, JULY 26, 1834. Price 3d.

MAGNETO-ELECTRIC RINGS.



MAGNETO-ELECTRIC RINGS.

Sir,—The article of mine, which you have done me the favour to insert at page 191 of the last (June) monthly Part, is not connected with the article of May 24, at page 114, but refers to another intermediate communication, which I conclude has altogether failed to reach you.* Besides the necessity of giving the article at page 191 a meaning, I hope what I now re-write and subjoin will be found to have sufficient intrinsic interest to entitle it to insertion, which I have to request for it as soon as convenient.

The advantages of the new method of the magneto-electric ring may be communicated to apparatus in which steel magnets only are employed, in any of the three following ways:—First, an armature of very large size is to be prepared, of the shape of fig. 1. The face *a c b* is to be made truly plain, so as to apply perfectly to the poles of a very large steel magnet; at *c d* a space is cut out of the armature, and its internal faces are finished very true. A disc, such as is described at page 191 (June Part, 1834), is then to be made of such a size as just to pass freely through the opening at *c d*; so also as that each face of the disc shall be in contact with an internal face of the opening. The disc is to be mounted on an axis, and must be capable of rapid motion; and some simple mechanism is to be attached to the axis, by which the poles of the armature wires may be disrupted on every successive intervention of iron or brass into the opening *c d*.

Now, analogy in general, and in particular some experiments, which I have gone through with very high magnetic powers, and which bear immediately on this subject—these authorise the conclusion that, when iron intervenes in the space *c d*, the magnetic current will pass directly through the space *a d b*, and leave the rest of the armature almost whole uninduced; when, on the other hand, brass intervenes, the whole of the armature will evidently be permeated. At each successive intervention, therefore, there will be an almost total disturbance of the magnetic equilibrium in the armature, which is the end required.

Fig. 2 represents such an apparatus: M is a compound steel magnet of any mass; A an armature such as already described, and D D′ is a section of the disc fixed in its place, and ready to revolve.

Figs. 3 and 4 represent different modes of development of the same principle. In these the armature is of the same shape with the magnet, and differs indeed only in being mounted with wire, and being made of iron. In fig. 3 the disc intervenes between one pole only of the magnet and armature. The other poles meet, and are in contact. In fig. 4 the disc works between both poles of the armature and magnet, and must be adopted with an additional prevention, namely, that iron may intervene between both pairs of poles at the same time, and also brass at the same time.

The last plan seems to promise the most complete disturbance of the magnetic equilibrium, but at the expense of great friction. The friction would be less in the third plan, and the fluctuation of the magnetic fluid perhaps not very much less violent and extensive than what would obtain in either of the other cases. An important advantage attends the last form of construction: it is that the armature, when necessary, may be used as an electro-magnet in charging or refreshing the component parts of the steel magnet. These forms of construction, however, although they offer results far beyond the power of those at present employed, are yet themselves just as far inferior in power to that of the electro-magnetic ring, in which electro-magnetism alone is the agent. It would require an enormous expense and trouble to construct a battery of steel magnets equal in power to such a ring as I have described: but supposing that it had been done, and a maximum steel battery had been constructed, the limit is arrived at, whereas the number of rings may be increased *ad libitum*, and one reverser will work them all.

Before I leave the subject, sir, I beg to add one or two supplemental remarks on the construction of the reverser and of the ring. It may seem strange that I have insulated by glass the point of juncture of the magneto-electric poles; my reason for doing so was, that I think it yet remains to be proved that the magneto-

* *It never reached us.*—ED. M. M.

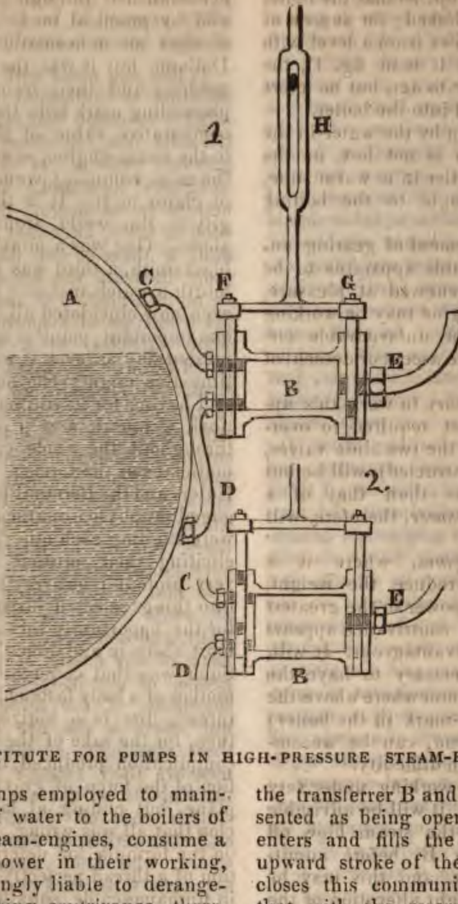
electricity is altogether impenetrative. My experiments, on the contrary, lead me to conclude that it has a low degree of penetrative power; and as the reverser is to be employed with much higher intensities of that electricity than have yet been developed, it seems but reasonable to make a suitable provision. Analogy leads to expect a penetrative power, though very low in degree; but still a penetrative power. If, however, as I have ventured to anticipate, there should even be a striking distance established, where very high energies are being excited, this will not only justify my foresight, but render the central apparatus altogether unnecessary. In such a case the poles of the armature coils could be used with the universal discharger, just as those of a powerful trough galvanic battery. I have also laid great weight on the advantage resulting from the solid continuity of the armature and magnet in the ring; in this, too, I think I am borne out by experiment and analogy. The theory of magnetism demonstrates that the magnetic fluid circulates with much more energy in a horse-shoe magnet when the armature is on the poles than when it is off; experiment also shows, that the more intimate the contact of the magnet and armature is, the greater is the development of magnetic energy. Consequently a magnet in the form of a segment of a circle will gain an increase of energy by the application of the supplemental segment to its poles, and the more intimate the contact of the poles of the two segments, the greater the mutual exaltation of their mutual engines: *ergo*, if the contact be that of solidity, the development of energy reaches the maximum. I conclude therefore, sir, that the degree of magnetic attraction developed between the two segments of the solid ring, exceeds what obtains between two similar separable segments, in the ratio which the partial contact that art can produce between two finely executed plane surfaces bears to the real contact which obtains in the transverse section of a solid. If we make a rough comparative estimate of the number of particles in actual contact in each case supposed, that ratio appears one of great inequality indeed; and so great must be the excess of energy developed in one case over that produced in the other. In fact, the effect appears to be the very maximum of what nature is capable of producing.

It fills the mind with wonder and admiration to endeavour to conceive the mighty estuation that takes place within the solid iron, on every reversal of the galvanic current. If there be one fluid in agency, how subtle must it be to penetrate in an instant the interstices of such a solid, and that longitudinally; and, if there be two fluids, how much more intricate the action. Or, if there be no transmission of the fluid, but simply a change of disposition of the ultimate particles, by a vibration propagated through the mass, we are equally struck with wonder at the constitution of the mysterious bond of solidity which can endure such a concussion, nay, a succession of concussions, without dissolution. Place a quantity of jelly on a table, and watch how it is agitated on the slightest stir; and what difference is there, but one of degree, between the condition of that yielding, trembling mass, and that of the firmest solid we know of, while under the influence of heat, light, and electricity? Then, again, we boast of our means of accurate intelligence, of our insights into, and measurements of, the minutiæ of nature; but where is the eye that will detect these vibrations, or the hand that may measure their extent? Why, the very instruments we use are themselves in a similar state of vibration of particles, and fluctuation of form; and we ourselves, who hold them, maintain an apparent form, and perform our actions only by a succession of pulses. Such considerations show man in his true position, as one benighted in a wilderness, and having a small lamp. Its rays show him a few things immediately around him with tolerable certainty, and he guesses at many more; while the paths that lead to the dark and the unknown, radiate on every side from his position, and stretch out into infinity.

I am Sir,

Your obedient servant,

Q. H.



SUBSTITUTE FOR PUMPS IN HIGH-PRESSURE STEAM-ENGINES.

Sir,—The pumps employed to maintain a supply of water to the boilers of high-pressure steam-engines, consume a great deal of power in their working, and are exceedingly liable to derangement; the following contrivance, therefore, is submitted as an efficient substitute, possessing the advantages of simplicity of construction and easy working.

In the accompanying diagram, fig. 1, A is the boiler of a locomotive-engine; B is a vessel, which I term a transferrer, and from which proceeds a pipe C, entering the boiler A, near the top; D is a second pipe connecting the transferrer with the lower part of the boiler; E is a pipe from the transferrer, communicating with a cold water cistern; F, G, are two slide valves, regulating the alternate communications between *the reservoir of water* and the boiler, *worked by a tappet frame H.*

In fig. 1, the communication between the transferrer B and the boiler is represented as being open; steam therefore enters and fills the transferrer. The upward stroke of the engine, however, closes this communication, and opens that with the reservoir (as shown in fig. 1), when cold water rushes into the vessel B, condenses the steam with which it was previously filled, and occupies its place. Another stroke of the engine brings the valve back into its first position, when the water immediately passes into the boiler, through the pipe D, by its own gravity, the pressure being equalised by the entrance of steam through the pipe C. The succeeding movement of the engine fills the transferrer with water, which is, in due course, discharged into the boiler, and so on continually as long as the apparatus is in motion.

By a proper adjustment of the transferrer it will continue to supply water

boiler till it reaches a given and then stop, so that the boiler ver become choked; for as soon as ter in the boiler is on a level with nsferrer (as it is in fig. 1), the may continue to act, but no more will be passed into the boiler.

heat taken up by the water in the condensation is not lost, as the nters the boiler in a warm state, sooner brought to the boiling

nple arrangement of gearing en- e action of this apparatus to be inued and renewed at pleasure, ng as the engine may be working favourable or unfavourable cir- nces, as in the ascent or descent of c.

power necessary to work this ap- will be that required to over- e friction of the two slide valves, (as now constructed) will be but certainly less than that of a the *forcing power*, therefore, will lly saved.

ocomotive-engines, where it is essential to reduce the weight, nomise the power to the greatest extent, this contrivance appears rticularly advantageous. It will, ases, be necessary to have the owed away somewhere above the high-water-mark in the boiler; s, I apprehend, can be accom- without much difficulty.

e engine is working under very eam pressure, it will be advisable portion of the steam blow off e transferrer B, before admit- e cold water, and this may be by a very slight alteration of the ism.

emain, Sir, yours respectfully,

WILLIAM BADDELEY.

derness-row, Goswell-street,
June 18, 1834.

COMPARATIVE VALUE AND IM- ANCE OF MATHEMATICAL SCIENCE, ON THE PRETENSIONS OF ITS PRO- RS.

Concluded from last Number.

s take other views of mathema- nd practical men bending their *towards the attainment* of the ect. *The most* valuable method of determining the longitude was at last accomplished through practical means, and by practical men. Euler aimed to produce an achromatic lens as well as Dolland, but it was the latter who suc- ceeded; and their respective modes of proceeding mark both the character and comparative value of their efforts. As to the steam-engine, science (other than the most common) cannot lay a particle of claim to it. It is the all-important gift to the world, from practical men alone. One was a miner, another was a blacksmith, a third was a glazier, and a fourth a watch-maker. Science has not even now elucidated all its principles,—one important point is as obscure at the present day as ever it was. During the time this mighty engine was maturing, and having for its ultimate effect a poli- tical, a moral, and a social revolution throughout the whole earth, the mathe- maticians of the foreign academies, the Eulers and the Bernouilles, even when en- gaged on physico-mathematical subjects, were exciting each other's ingenuity, and eliciting their mutual admiration, by very profound but very sterile inquiries, into things selected purposely and merely for the opportunity they afforded for the most abstruse and difficult investigations. Such was that concerning the gyratory motion of a body fastened to an *extensible* thread, first in a horizontal plane, and then, for the sake of the choice piece of complication produced by the introduc- tion of the force of gravity, in a vertical plane, but ending at last with a suspi- cion that all was wrong. Such was that on the formulæ for determining the mo- tion of a thread perfectly flexible, ending in unmanageable equations. And such was that concerning tractory and com- pound tractory curves, formed by a weight in one case, and two or more weights in the other, being moved by a thread whose end travels along a line either straight or curved, ending also unsatisfactorily. *Your* Magazine, Mr. Editor, is also the theatre occasionally for the display and sharpening of the wits of certain geome- trical correspondents. Such was the tendency of the problem lately proposed and solved—"To inscribe a quadrilateral in a given circle, having given each of the diagonals and area." Why should not these have their puzzles as well as the more profound analysis? They form good school-boy exercises, and school-

boys accordingly have sustained a conspicuous part on your stage. Some persons are particularly apt at such questions, and so are others at solving riddles. The differeent manner in which the proposal for an undulating in lieu of a level railway has been received by the *mere* mathematicians on the one hand, and by the body of civil engineers on the other, is also abundantly significant of the comparative rank and importance which the former hold in the scale of intellect and utility. Your correspondents, Kinclaven, Iver Maciver, and M. S., are mathematicians—geometricians, at any rate—and they have sided with Mr. Badnall. Be it so—the impress is of their own stamping, and the currency is their own issue.

The limits to which I am confined will permit me merely to allude, and only to a few more instances of the unfitness of the mere mathematician for physical inquiries, and of the unsatisfactory applications of their science. At one time the animal economy was mathematically and mechanically explained. The treatises on physiology were filled with problems, long calculations, and algebraic formulæ. Lawrence says, "that one estimated the force of the heart as equal to 180,000 lbs.; another reduced it to 8 oz.; and both these conclusions are deduced from reasonings clothed in all the imposing forms of the *exact* sciences."

Even the phenomena of the mind have been forced within the pale of mathematical disquisition. Hartley's elaborate hypothesis of the *vibratory* nature of thought and feeling would afford a choice and subtle theme for analysts of the French school, if only a few facts could be found to give it a colouring of truth, and a plausible pretence for the application of the calculus. We may then hope to find an expression for the velocity of our ideas, with the corrections due to variations in the temperature, moisture, and tension of the medullary fibre!

To come to our own times, there is Sir R. Phillips's theory *of all things*—ingenious enough, but that is all. Then there is Mr. Herepath's mathematico-chemical theory, accompanied with a challenge to the Royal Society, and preposterously backed with an offer to wager *1000l. on the issue*, in which the *molecules of the gases are continually jostling each other and perpetually at loggerheads.* The whole scheme is, however, mathematically and demonstrably true, especially if reasoning in a circle be only a circuitous way to truth.* Then there is the more measured movement of the ultimate particles of matter according to the theory of Mr. Emmet, by reason of the altered ratio of the forces which previously held them in equilibrium—the disturbing force being caloric. More recently there is the somewhat similar, but more elaborate and comprehensive, atomic theory of Mr. Exley, a work which I approach with the greatest respect, for the many profound, ingenious, and philosophic views with which it abounds; and for the very numerous explanations of phenomena which he adduces in accordance with his hypothesis, and which give it a much less speculative cast than the theories previously mentioned. The laws, however, which govern the immediate action of the atoms, if such there be, are probably not scrutable to our means or faculties; and it must be doubted whether our knowledge, even of the elements of matter, is sufficiently advanced, to admit of such mathematical disquisitions: the attempt at present appears to be premature, though possibly it may be ultimately successful; and, in the mean time, the experimental researches of philosophers, with Mr. Faraday at their head, will be more useful, and teem with results of greater consequence. What an important, though simple fact, has lately been brought to light by this gentleman, and how much of a practical character there is about it, that the chemical action of platina, in certain cases, depends on its being perfectly *clean:* a circumstance which your very profound thinker, with his algebraic formulæ, would run every chance of overlooking, because it is just on the surface of things. The sagacious practitioner having his attention alive to every

* This conspicuous herald of his own and Mr. Gurney's fame, will surely be satisfied if his theory be as true as his assertion, that Mr. Gurney's steam-*drag* would transfer the same weight as it does on a common road, "*two hundred and sixty* or *two hundred and eighty* miles per hour on a railway, supposing mechanical laws followed, and that the materia's and the resistance of the atmosphere would allow it." A slight mistake this—identical with Kinclaven's—of supposing the expenditure of power not to follow the ratio of the velocity as well as the resistance. This is another instance, by-the-bye, on the part of both these persons (for they are *one* only in error, I imagine), of mathematical fitness and sagacity for physical inquiries.

incident, attaches no undue importance to what is recondite, or undervalues any thing because it has not the air of being scientific or *recherché*.

I have thus endeavoured to mark the peculiar deficiencies for just reasoning and original investigation, to which the mere mathematician is liable from the biassing tendency of his studies, the natural bent of his mind, and the engrossing occupation of his time. I have illustrated this position with as many instances as my limits will allow, and I have incidentally shadowed forth the true and philosophic mode of conducting inquiries into the mixed and complex affairs which surround us on every hand. In pursuing this subject, there are one or two points on which I wish to guard against misapprehension. It is not intended then to impugn any of the methods adopted by the mathematicians in their own science, as purely considered, however they may have differed among themselves respecting them. Still less is it intended to impugn the modes of procedure adopted in the mixed mathematics, or to complain of what has been *fitly* done herein; but rather of what has not been *so* done—of premature applications of the science before the phenomena of nature have been sufficiently investigated to warrant an hypothesis—of inadequate applications, from a too great sacrifice of physical considerations in deference to the exactness of science—of partial applications being assumed to be complete, or, at any rate, to be of greater pretension and value than avowedly irregular but more comprehensive modes of considering the subject, and of such applications being put forward in lieu of, and in preference to, tentative proceedings, even when the case points to and admits of their being adopted. Neither is it intended that these observations, or mere hints rather, concerning the true and more ample mode of philosophising, should point to the analytic more than to the synthetic method, for they refer to both; and the reference is also as much to the secret mental process as to the published and formal procedures. The former is a curious subject, of which scarcely any thing can be known, and the little we can conjecture of it must *arise from a knowledge of* what passes *in our own minds*. How intensely interesting would it be to have before us the workings of such a mind as Newton's, whilst maturing his immortal system. We have a glimpse of such things in what is told of Kepler—of his shrewd guesses, tentative methods, and ultimate success in discovering by these means the two laws of the planetary motions which bear his name; and also in what is related of the cut and weighed paper proceedings of some of the geometricians. The results of course appeared in systematic mood and scientific dress. The works of Newton gave evidence of certain secret and facile means, before the method of fluxions was announced or known. We have also in the detail of the experiments which led Sir Humphry Davy to the discovery of the miners' safety lamp, an interesting instance of this mental process, at least of the general course of his thoughts. We are not to imagine that the analysis or synthesis, as brought forth to public view, is, in its mental elaboration, a direct and straightforward affair. Doubtless there are alternated or mingled methods of resolution and composition, of experiment, tentation, and verification, in a round of mixed proceedings; but from this seeming chaos of thought the plastic spirit of true philosophy evolves coherent forms of symmetry, of truth, and beauty. The heart of man is a secret thing; but the mind of man is yet more impenetrable. I would also wish to be understood as not contemning mathematical acquirements in the slightest degree, but as pleading for their use in opposition to their abuse, and as moderating only the overweening pretensions of their value and importance, both in an intellectual and useful point of view, in which the *mere* mathematician is apt to indulge.

It may be expected from me that I should apologise for assuming the censor in such sort. I beg, then, in justification and corroboration of my opinions, to quote the following sentiments, which have come under my notice since the preceding observations were written. In fact, the treatise in which they appear is just published:—"In mathematics we go smoothly on, neither turning to the right hand nor to the left; there is, in fact, no alternative presented to the mind—we cannot do otherwise than give our assent to what is before us. There is no weigh-

ing, no balancing of collateral evidence, or consideration of circumstances, such as often clog and impede our progress in many of the other branches of knowledge. How often do we hear mathematicians bewail the difficulties they meet with when they wander from their own folds; and how often do we hear them give utterance to the pleasing but forlorn hope of seeing all knowledge reduced to mathematical certainty and precision?"—"If we examine mathematics in an intellectual point of view, there appears to be something of a mechanical turn in the acquisition of its truths; and it is by no means evident, that to excel in mathematical investigation, the more lofty and elevated of our mental powers are required to be brought into exercise. There is a fact besides, established by the history of philosophy in all ages and countries, which pointedly bears out this opinion; namely, that we have daily instance of persons making themselves proficients in mathematical science at a very early age; but we never find that a person becomes eminent in mental, moral, or political philosophy till more advanced in life. This is a fact founded upon the natural course of the human mind, and clearly teaches us, that higher qualities of intellect are required to reason upon and comprehend questions on topics relating to human affairs, than are necessary in the solution of problems connected with the pure sciences."—*Blakey's System of Logic.* 1834.

There is another very important topic connected with this subject, which is, the hurtful influence which mathematical studies, or rather, which a taste for the abstract mathematical method, has had on general reasoning, and on the tone and manner in which investigations into things in general have been conducted—a taste, which taking its origin in the mathematical predilections which succeeded the downfall of the old scholastic methods, has, from the ease and convenience which it affords, for taking determinate but narrow and contracted views of things, and the flattering but fallacious assurances it fosters of clearness, decision, and certainty, infected the universal mind, and marred the philosophy of the age. The length of this article, already too extended for a single communication, precludes me from appending my observations on this topic; but they may probably form the subject of another letter, if you are of opinion, Mr. Editor, that such matters are not foreign to the scope and objects embraced by your highly useful and valuable miscellany.

I am, Sir, yours, &c.

BENJ. CHEVERTON.

P. S.—Kinclaven says that I decline giving a solution to his undulating railway question, and assumes that it is "beyond my reach," in which he both says and assumes more than he is warranted to do. I merely say that he is not entitled to challenge me to the discussion of another subject before the former one is disposed of, especially as his object is to evade it, for "he knows right well" that the onus lies with him. As to the question itself, I do not see any difficulty in its solution; but he might as well have stated it intelligibly. He puts a case of velocity as being produced, and then naïvely asks—how much of this existing velocity is destroyed?! I am to guess, I suppose, that he alludes to the potential velocity. I beg to acquaint him, if it be a matter of any interest to him, that I am not, as he supposes me to be, an engineer.

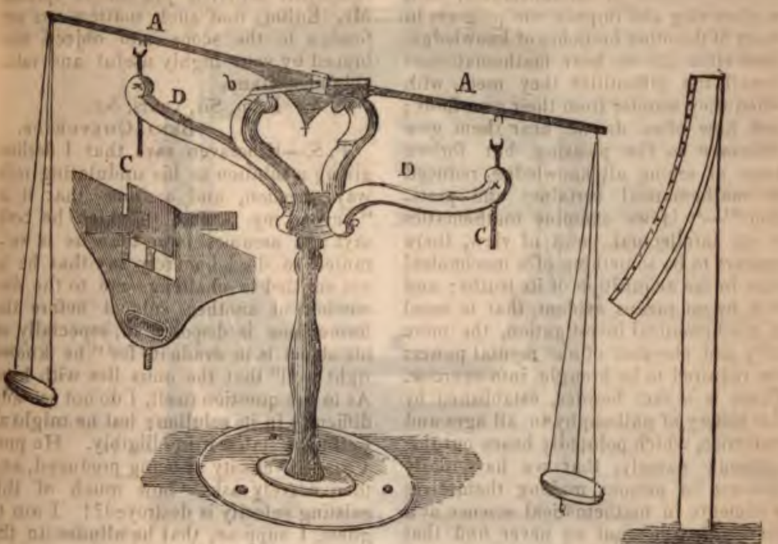
PECULIAR APPLICABILITY OF ISOMETRICAL PERSPECTIVE TO BUILDING PLANS.

Sir,—The general application of "Isometrical Perspective" to architecture has been mentioned, and, according to your valuable correspondent "R," is making progress. I would beg, however, to direct particular attention to its use in representing the plans of each floor of any building. Horizontal sections of the walls being taken at a few feet above the floors, ascending or descending steps, or the foundations on irregular ground, in this way become obvious, and next to an actual model. It is unquestionably the very best method of giving, by a drawing, a correct notion of an intended building; and particularly so to those who are not used to architectural drawings, and who frequently experience much difficulty in understanding them, even when personal explanations are given. A plan of any floor of a building thus drawn in isometrical perspective a child can understand.

I am, Sir,

Your obedient servant,

JOSEPH JOPLING.



DELICATE BALANCE.

Respected Friend,—I beg to offer the accompanying sketch of a delicate balance, an indispensable article to the analytical chemist, and generally a very expensive one. This is upon the same principle as the one proposed by the "Under-graduate of the University of Cambridge," at page 440, vol. xv., but will, I think, be found superior, certainly more elegant. The beam consists of a light slip of cedar wood, A A; the axis, of which an enlarged view is given in fig. 2, may be moved by means of the screw, so as to raise or depress the centre of gravity; the knife-edges play upon two pieces of thermometer tube *b*, upon which the friction is extremely small.

The beam is regulated to the same position, by means of the two supports C C, which catch into two grooves in the beam, and on turning the screws at the extremities of the arms D, the supports drop from under the beam; they serve also to take the weight of the beam from off the knife-edges when it is not in use. The needle at the end of the beam points to zero on the index when perfectly level; the scale-pans are very small watch-glasses, one of them carrying a small hook, on which can be fixed a fibre of silk, for taking specific gravities.

The scales should be kept in a glass case, to prevent their being disturbed by currents of air; the frame may be of tin.

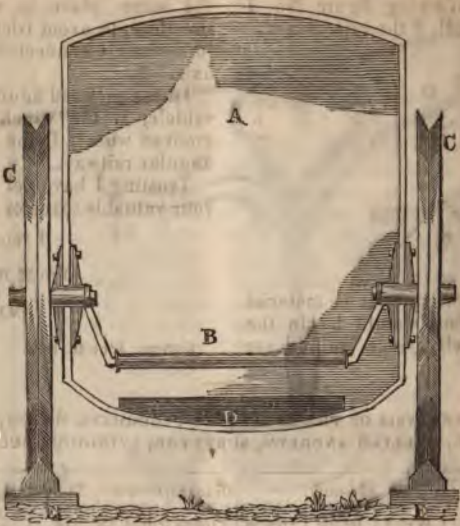
Such as desire further information on the subject of the balance, may consult, with advantage, the paper of the "Under-graduate," before referred to, and one by Mr. Ritchie, vol. vi. page 147.

I may add, that the scales I have been describing are sufficiently sensitive to indicate the $\frac{1}{100}$th of a grain, and may therefore be depended on to 3 places of decimals. They were made by an ingenious mechanic of this city, of the name of Davis, and would do credit to a London workman. The support and arms are of brass, but they might be more economically made of wood.

Thine truly,

HENRY WATSON.

Chichester, June 19, 1834.



MR. SNOWDEN'S RAILWAY-CARRIAGE IMPROVED.

Sir,—As there cannot be any difficulty in placing the cog-wheel vertically, instead of horizontally, as shown in Mr. Snowden's invention, No. 566, permit me to forward you a plan for that purpose, by which it appears a large portion of friction will be avoided, less machinery required, and a greater facility in working the winch afforded; the men being enabled to sit opposite to each other, and thereby exert their powers with greater effect.

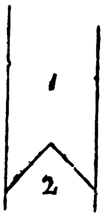
I should esteem the use of a fly-wheel superfluous, as the impetus of the carriage, when in motion, would be sufficient to equalise the power. Besides, the fly would render it more difficult to arrest the progress of the vehicle when required. I should consider it better to have a wheel with a strap and lever (as used in cranes), to stop the movement when required.

If the projectile force required were 120 lbs., and the diameter of the cog-wheel 4 feet 6 inches, the radius of the winch 12 inches, and four men employed to turn it, 27 inches being the radius of the cog-wheel, a proportionate increase *of force would be required* to turn the winch, according to the well known laws of leverage power. Now as 27:12 ::270 to 120, therefore the four men must each exert the strength equal to 68 lbs. (without accounting for friction) to overcome the resistance or inertia (if I may use the term), and put the whole in motion; and as 120 lbs. is the resistance or friction of a dead weight, equal to 960 lbs. on a level surface, the slightest inclination would proportionately increase the power required.

If my views of the thing be correct, it would be needless to attempt to argue the practicability of using manual labour in such a way; but were steam-power employed, *applying the strength of a horse or two instead of a man's*, the case would be very different.

With the view, at the same time, of preventing the danger arising from the wheels getting out of gear, from stones or other materials lodging on the rails, and also to keep the wheels in place, even should a section or two of either rail be a little out of place, I propose that the rail should be angular, and the wheel grooved. The edge or angle

rail to be central to the rim of the In the following figure, No. 1 nts the wheel, 2 the rail.



not know whether it is material e friction-box should be in the or the vehicle, [since springs are not used (the strain on the axis being in the same place in either case), and therefore, to avoid friction, the winch is immediately connected with the wheel-axis.

In the prefixed figure, A represents the vehicle, B the winch, C the angular-grooved wheel, D the foot-boards, E the angular railway.

Trusting I have not taken too much of your valuable space or time,

I remain, Sir,

Yours respectfully,

JAMES WOODHOUSE.

Kilburn, June 18, 1834.

:HANICAL ANALYSIS OF THE AYLESBURY PLOUGHING MATCH, MAY 21, 1834, BY MR. WILLIAM ANDREWS, SURVEYOR, IVINGHOE, BUCKS.

Proprietors.	FURROW.			Draught of Plough in cwts.	Proportionate effect in sup. in. per cwt.	Time taken in hours & minutes.	Speed in miles per hour.	
	Width in inches.	Depth in inches.	Area in super. inches.					
Jos. Read ...	9	4½	40½	6¾	6.	2 21	2.02	
Thos. Proctor	9½	4¼	40½	7	5.75	2 26	2.25	
T. R. Barker..	9	4	36	6	6.	2 13	2.07	
Jos. Ballard ..	8½	4	34	6½	5.23	2 31	1.82	Only ploughed part of the land and left the field.
H. T. Young..	9	5	45	6	7.50	....	1.83	
Wm. Perrin..	9	4	36	6	6.	2 7	2.50	
Jos. Lucas....	10	4	40	5	5.	2 2	2.32	Prize £3.
Rd. Harding..	9	4½	40½	6½	6.23	1 58	2.22	
E. Horwood..	9	4½	40	5½	7.27	....	2.08	Removed the greatest quantity of soil in the least time.
C. Cooley	9½	4¾	45	7	6.43	1 58	2.60	
. E. N. Young	9¼	4¼	39¼	8	5.	2 7	2.05	Prize £1.
James Dover..	9	4	36	5½	6.54	2 10	2.33	
John Cooling	10	4	40	5½	7.27	2 10	2.35	
E. Horwood..	10	4	40	5	8.	2 31	1.95	
T. Horwood ..	9	3¾	34	6	5.66	2 16	2.50	Prize £2.

ove lands consisted of about half an acre each; the maximum time allowed by the Committee hours, the land being a hard fallow of stiff clay. The ploughs were chiefly the common Buck-ire foot ploughs. No. 3, 6, and 13, had what are called iron broadboards.

COMBUSTION OF WATER.

Sir,—Referring to the last two phs in your notice of Mr. Morey's us invention (the vapour lamp), Mag., 569, p. 233, will you per- : to ask Dr. Jones, the learned of the "Franklin Journal," to his European readers with an ex- *of his own theory*, if he have *the modus operandi*, by which "the introduction of the vapour of water among burning fuel has, under many circumstances, the effect of quickening the combustion, and, more especially, of enlarging the flame?"

Dr. Jones will have no difficulty in understanding why I should feel more than ordinary interest in this question; and I think Mr. Morey will be

equally obliged as myself, if he will explain to us the principle of our respective inventions.

Whilst at all times I desire to manifest a becoming deference for all editorial decisions, I am sure, sir, Dr. Jones cannot expect, or desire, that a few dashes of the editorial pen should be viewed as conclusive arguments, unless supported by previously ascertained facts, or, in the absence of these, by the fair deductions of analogy.

If the decomposition and recomposition of water were direct, instead of intermediate, Dr. Jones would probably be justified in supposing the two processes must neutralise each other. It appears to me that the objection he has supposed to exist, in reference to the vapour of water, may, with equal propriety, be applied to coal, or oil, or any other combustible body. The advantages arising from the decomposition and recomposition of any of these materials are due, not to direct decomposition and recomposition, but to the intervention of an auxiliary element, viz. oxygen. I know of no process by which the direct and simultaneous decomposition and recomposition of water may be effected. Is it not incompatible with our experience, and the nature of things?

Dear Sir,

I am your faithful servant,

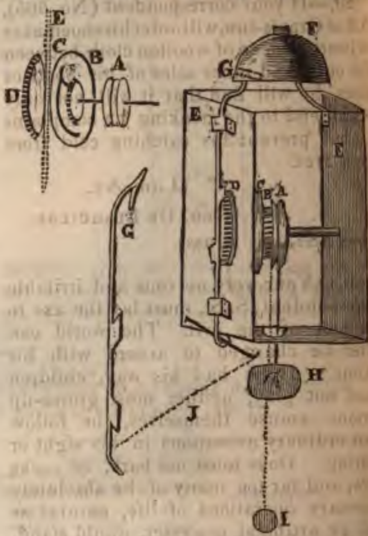
J. O. N. Rutter.

Lymington, July 8, 1834.

TIME MONITOR.

Sir,—I forward for the information of "A Brewer," as well as of others under similar circumstances, a description of a simple and efficient alarum, which I have seen in successful operation. It was constructed, and (I believe) invented, by an old man, a clock and watchmaker of this place, long since "numbered with the dead."

E E is the case. A a pulley. B a ratchet wheel, with a spring and catch. C a round flat wheel, on which the spring and catch are fastened, suffering the pulley and ratchet wheel to go round together when the machine is wound up, while the rest of the works are still. G a rod with a double hammer at the top, *and two flaps lower down*, like those on *a watch verge*, which are worked by the pins on the wheel D, thus making the hammer strike alternately on each side the interior of the bell F. J is a piece



of string attached to the wire, which being put up against the bent end of the lower part of the hammer, hinders the machine from "running down," after it is wound up. The other end of the string is fastened through a hole in the case to the weight of a common clock, which must be drawn up at a particular time every night, and when the weight has got low enough its gravity will pull the wire down, which liberates the alarum, making such a noise as cannot fail to wake any person from a natural sleep. The machine may be placed close to the bed, and the string conducted to the clock, though at the distance of two or three rooms. By lengthening the string the machine may be made to alarm at any time after the clock is wound. Supposing the string is so long, that it will alarm after the lapse of six hours, then if a person wishes to be roused at three in the morning he must wind up the clock precisely at nine the night before; attach the string to the wire, the alarum being previously wound up, and all is ready. This may be made mostly of wood, and cannot cost much.

I am, Sir,

Yours with respect,

W. Pearson.

Bishop Auckland, June 3, 1834.

KING SHOES, AND SHATTERED NERVES.

If your correspondent (No. 565), ray's-inn, will order his shoemaker a piece of woollen cloth between and inner soles of his boots or e will find that it will not only nd to the creaking he complains prevent his catching cold from et.

I am, &c.

GEO. DE BLAQUIERE.

ire, June 10, 1834.

Your very nervous and irritable ndent, S. S., must lay the axe to of the evil. The world can e changed to accord with his If he had his way, children t play, neither must grown-up amuse themselves, or follow linary avocations in his sight or Dogs must not bark, or cocks d far too many of the absolutely y operations of life, natural as artificial processes, would stand, d his mind of things. The only hat I can give to S. S. is this—he opt a plan of living, similar to I have given in No. 546 of the Mag. I am certain that if he he will find himself in a state tted to bear what he now con- urdensome in less than three ; and in two or three years after will be in a better state of mind y than most persons. If S. S. indulged, he may take a cup of t half time between breakfast ner; and he may also use a little jelly, or some prepared fruit, to first meals. It is not good to se of fruit or coffee towards He will know by his feelings, ne after a meal, if he has taken h food.

I am yours truly,

JAMES WHITELAW.

, June 25, 1834.

CENT AMERICAN PATENTS.

ected from the Franklin Journal.]

INE FOR MAKING COTTON ROVING. *oseley.*—This machine for making *ving, or roping, is in many of its lar to those already in use for the ose. The parts claimed as new* are "the general combination of that part of the apparatus by which the condensing is effected; the reciprocating roller and revolving apron used, not being claimed singly and separately, they having been previously used, but only the particular manner in which they are arranged and combined; by which mode of arrangement the desired end is most perfectly obtained, which had not been accomplished by any of the arrangements heretofore made. The single geared cone is also claimed as constructed, and connected with the other parts of the machinery, upon the principle, or in the manner set forth; this single geared cone being applicable, and intended to be applied, to other machinery used in the manufacture of textile substances."

The particular arrangements referred to cannot well be explained without the drawings; a tolerable idea, however, may be formed of that part called the geared cone, from the description, which is as follows:—"This geared cone consists of any number of toothed wheels, say seven or eight, gradually increasing in size, so as to give them, when combined, a conical appearance. They are connected together, but slide upon their shaft, by means of a feather, which allows them so to do, but causes them to revolve with the shaft. The wheels which constitute this cone are thrown alternately into gear with the machinery which produces the traversing motion of the carriage, and the winding of the condensed roping upon the spools. The cone, as thus constructed, is a great improvement upon those before used, which were double, in order to their producing the effect intended. The sliding of the geared cone upon its shaft, which is essential to it as a single cone, obviates the necessity of much gearing, and among its many other advantages, possesses that of being very easily shifted."

FORCING PUMP. *Benj. Saphan.*—Although the principle upon which this pump operates is old, there is an arrangement of the parts sufficiently new upon which to found a claim for a patent. The principle is the same with that of the *pompe des Pretres*, first, we believe, used in the *Jardin des Plantes*, in Paris, at least a century ago; and described in some of the books as a "pump without friction," for although it is not absolutely so, the ordinary friction of the piston is entirely dispensed with; a diaphragm of leather crossing the chamber, being made to perform the office of the piston.

In the pump, which is the subject of this patent, the leather diaphragm is used, and is made to act so as to convert the instrument into a double forcing pump. The body of the pump is made in two parts, each of which will bear a resemblance to a common

wash hand bowl, with its projecting rim, representing the flanches by which the two parts may be bolted together. When they are attached to each other, a piece of leather crossing the body of the pump is enclosed between the flanches, and is left bagging in the inside, so that it may play from side to side. The piston-rod passes through a stuffing-box in the centre of one of the halves of the body, and is secured to the centre of the leather diaphragm; and a lever at the outer end, acting like a pump-handle, will serve to work it backwards and forwards. The leather is stiffened by pieces of metal so placed as to render its vibratory action efficient.

Projecting from opposite edges of the body, there are short tubes or necks, to which to attach the pipes for the supply and discharge of water; one half of each of these necks being cast with each half of the body. Two semicircular valves are contained in these necks; those belonging to the supply tube opening inwards, and those to the discharge tube outwards.

This description will render the general arrangement manifest to those acquainted with hydraulics, and will, to them, point out the difference between this pump and those on a similar principle which have preceded it. The patentee observes that, "as the altitudes or positions in which this pump may be placed, and the modes in which the lever or handle may be applied, are various, it is unnecessary to specify any one in particular." The claim is to "the double chamber and leather partition piston, supported by plates of metal as above specified, as essential parts of this improvement."

RAIL-ROAD CARRIAGE WHEELS. *John Elgar, C. E., Philadelphia.*—The self-adjusting conical wheel for running on curved roads is well known to engineers. It is used in a modified form on the Baltimore and Ohio railroad. The present patentee, instead of making the wheel conical in its whole tread, or making the part against the flanch conical, and leaving the other part cylindrical, as is the case with those on the Baltimore road, forms the cone on the outer part of the tread of the wheel, opposite to the flanch, leaving that part of the tread which extends from the flanch towards the opposite side, cylindrical, or nearly so, for one half of its width, more or less, and then tapering outwards in such degree as may be most convenient, according to the curvature of that part of the road which has the smallest radius. The curved part of the road is adapted to these wheels, by widening the track in proportion to the radius of curvature, so as to admit the conical part to roll on the interior rail, whilst the cylindrical part bears upon the exterior rail. This construction obviates the objection arising from the wrong tendency of the cone when running on the exterior rail, and adapts the whole more perfectly to those parts of the road which are straight, and produces other advantages which will readily occur to experienced engineers. In order to render rail-road wheels more firm and durable than those now in use, Mr. Elgar forms that part of the wheel usually occupied by the spokes, of two plates of iron, preferring for this purpose thick sheet iron of three-eighths of an inch, more or less, in thickness. These sheets of iron are raised so as to be concave, or dishing, forming the segments of a large sphere or if preferred, they may be made conical. These plates have a hole in their centres to receive the hub, or nave, and have a flanch turned up over which the hoop of the hub may pass; or, if preferred, the hub may be secured in other ways. If the rim, or tire, is of wrought iron, the plates may have a flanch turned at their peripheries, through which they may be riveted on the interior of the rim. When the rim is of cast iron, the plates may be secured without a flanch, one being cast within the rim, on either side, against which the plates may fit, rivets or bolts passing through them, and through the flanch, to secure them in their places.

IMPROVEMENT IN THE EVER-POINTED PENCILS. *James Bogardus, New York.*—This improvement consists in so arranging the parts of an ever-pointed pencil-case, that the point which holds the pencil shall be obtruded and detracted without having a slot in the side, with a ferule and a pin to draw it down, as is ordinarily done. The exterior case consists of a continuous cylindrical tube, without projections or openings. To cause the point which holds the pencil to protrude, the head of the pencil-case is made to revolve; this acts upon an interior tube by means of a quick-threaded screw, which should, in preference, be made left-handed. The chamber for spare pencils, and the holding point, remain as heretofore. A competent workman will readily conceive, without the aid of the drawings, how the respective parts should be arranged. In the specification these are clearly set forth, and the claim is to "the application of the coarse-thread screw, either direct or back-handed, and the general arrangement of the parts as herein described." We presume that pencil-cases may be made in the way proposed at a cost but little exceeding the usual construction, and they will certainly be more neat, and less liable to admit lint and dust from the pocket.

MACHINERY FOR PROPELLING VESSELS. *John M'Curdy, of Norwich, Connecticut, now residing in London.*—The apparatus which is the subject of this patent, is called "the duplex crank propellers." Paddles of

which may be preferred, are to and to leave the water vertically; le being operated on by two cranks, of which are placed horizontally the other. The two cranks ap- to each paddle must be equal in nd when attached to the paddle ust stand in the same direction; hen, in their revolution, carry the that every part of it will perform ual to the sweep of the cranks. y be several pairs of cranks on the ts, each carrying its own paddle, ling at different angles, so that em will always be acting on the he claim is "simply the arrange- connexion of the rods, or arms, to cranks, acting together, with the tached to the lower end, by the of this motion forming a complete

-SWEEPING MACHINE. *Levi Kid- York.*—This machine was designed e of the city of New York, and it ipated that it would produce a ng in the business to which it was ied. A cylindrical broom was to y means of the wheels of the ma- ich was to be drawn like a cart. the receptacle for the dirt, were overed, the whole being managed er that manifested much ingenuity. many difficulties, however, in the he successful operation of such a among these may be mentioned s, and other inequalities in the of a city, against which it must be not altogether, impossible to pro- ers equally formidable might be l, but we shall be glad to see machine has met with and con- em.

ED MODE OF BUILDING WALLS WATER. *Henry K. May, Bos-* allel rows of piles of sufficient extend above the surface of the to be driven down, leaving such a ween them as shall be necessary for ness of the wall to be built. These to be sustained in their places by spur shares on their outsides, and capped with strong longitudinal A platform for the workmen, and the windlasses and materials, is to these caps. A stout frame is to d by uniting transverse and longi- imbers; the transverse timbers be- ength equal to the thickness of the wall, and the longitudinal ones of a ual to such a section of it as is in- be built at one time; the whole essarily be thus divided into distinct *carry the proposed plan into* effect. *this frame the transverse timbers* are placed at suitable distances, parallel to each other, and the longitudinal timbers upon them; one being situated near their ends on each side, and the whole secured together by trenails, or otherwise. This frame is to be slung under the platform upon which the windlasses are placed, by ropes, attached to blocks, and passing under the projecting ends of the transverse timbers. When so placed, the foundation of a section of the wall is to be laid upon it. The stones, cut to a proper size, are to be laid in the manner of headers and stretchers, the first row of headers extending from one longitudinal piece to the other, immediately over the transverse timbers, and the first row of stretchers extending from one of these to the other, immediately over the longitudinal pieces; these courses are to be continued, and the frame lowered into the water, until the wall reaches low water mark. The spaces between the headers and stretchers are then to be filled in with rubble work. Section after section is thus to be built, until the whole wall is completed.

LIST OF NEW BRITISH PATENTS, GRANTED BETWEEN THE 22D OF JUNE AND THE 22D OF JULY, 1834.

Richard Walker, of Birmingham, manufacturer, for an improvement in wadding for fire-arms. June 26; two months to specify.

Jonas Bateman, of Islington, cooper, for an apparatus or instrument for saving human life, or other purposes, in case of shipwreck or other disasters by water. June 30; six months to specify.

John Barton, of Providence-row, Finsbury, engineer, and Samuel and Joseph Nye, both of Saint Andrew's-row, Southwark, mechanics, for improvements in the construction and application of pumps for raising fluids and other purposes. July 1; six months to specify.

Thomas Barton, clerk, of Withby Bush, parish of Rudbuxton, county of Pembroke, for certain improvements in engines or machinery for cutting or preparing slates, or other similar substances or materials for various useful purposes. July 3; two months to specify.

James Hardy, of Wednesbury, Staffordshire, gentleman, for a certain improvement or certain improvements in the making or manufacturing of axletrees for carriages. July 3; six months to specify.

Benjamin Hick, of Bolton-le-Moors, engineer; Edward Evans, the elder, of Oldham, coal proprietor; and John Higgins, of Oldham, engineer, for certain improvements in the construction and adaptation of metallic packings for the pistons of steam and other engines, pumps, and other purposes to which the same may be applicable. July 4; six months to specify.

William Higgins, of Salford, machine-maker, for certain improvements in machinery used for making twisted rovings and yarn of cotton, flax, silk, wool, and other fibrous substances. July 7; six months to specify.

John Gold, of Birmingham, glass-cutter, for certain improvements in cutting, grinding, smoothing, polishing, or otherwise preparing glass decanters and certain other articles. July 7; six months to specify.

John Aston, of Birmingham, button-maker, for an improvement in the manufacture or construction of buttons. July 10; six months to specify.

George Beadon, of Taunton, lieutenant in the Royal Navy, for a machine or apparatus for preventing boats or other floating bodies from capsising or overturning when oppressed by too much sail, and for easing off the ropes and sheets of different classes and descriptions of vessels, parts of which machine or apparatus may be applied for other purposes. July 10; six months to specify.

Lemuel Wellman Wright, of Sloane-terrace, Chelsea, engineer, for certain improvements in machinery for cutting tobacco, and which machinery may be applicable to other useful purposes. July 10; six months to specify.

John Ramsbottom, of Todmorden, mechanic, and Richard Holt, of the same place, iron-founder, for certain improvements in the construction of power-looms for weaving cotton and other fibrous materials into cloth or other fabrics. July 12; six months to specify.

Peter Wright, of Edinburgh, manufacturer, for an improved method of spinning, twisting, and twining cotton, flax, silk, wool, or any other suitable substances. July 17; six months to specify.

William Septimus Losh, of Walker, county of Northumberland, gentleman, for an improved method of bleaching certain animal fats, and certain animal, vegetable, and fish oils. July 17; six months to specify.

James Warne, of Union-street, Southwark, pewterer and beer-engine manufacturer, for certain improvements in engines or machinery for raising, drawing, or forcing beer, ale, and other liquids or fluids. July 17; six months to specify.

NOTES AND NOTICES.

Mr. Russel's Steam-Carriages.—These vehicles have continued to perform their trips with increasing success. The following is the running of the three last days, the time being reckoned between Tradeston, Glasgow, and the Tontine, Paisley:—

Thursday, 17th July.

10 o'clock	coach	to Paisley	40	minutes.
11	....	to Glasgow ..	48	..
12	....	to Paisley	58	..
1	....	to Glasgow ..	38	..
2	....	to Paisley	56	..
3	....	to Glasgow ..	59	..

Friday, 18th July.

10 o'clock	coach	to Paisley	44	minutes.
11	....	to Glasgow ..	45	..
12	....	to Paisley	35	..
1	....	to Glasgow ..	39	..
2	....	to Paisley	45	..
3	....	to Glasgow ..	43	..

Saturday, 19th July.

10 o'clock	coach	to Paisley	34	minutes.
11	....	to Glasgow ..	33	..
12	....	to Paisley	32	..
1	....	to Glasgow ..	35	..
2	....	to Paisley	55	..
3	....	to Glasgow ..	44	..

We have only further to remark, that on the last two trips the anxiety to get places was so great that the carriage to Paisley took out twenty-eight passengers, and returned with thirty-nine.—*Glasgow Herald, July 21.*

The *Constitutionnel* of Friday last gives an account of a first experiment made at Paris, on the day before, with a carriage rigged with sails. It started from the Military School, crossed the bridge of Jena, stopped in the Place Louis XV., and returned thence to the Rue du Mont Blanc. During part of the journey the wind was almost right a-head. Carriages have been occasionally propelled in this way times without number; but to place any permanent dependance on a moving power of such variable strength and duration as the wind, is of course out of the question.

Mr. Burden's Steam-Raft, about which so much has been recently said, is built literally after a plan suggested by a correspondent (Paupertas) of the Mechanics' Magazine, as far back as Sept. 4, 1824.—See vol. ii. p. 407. E. S. P.

An American newspaper states, that a Mr. Welch, of Annapolis, having failed to get rid of several warts on his hands by nitrate of silver, &c. tried electricity, when, by sending sparks through them for five minutes daily, during five days, the whole of them disappeared.

The London and Birmingham Rail-road.—This magnificent enterprise is now proceeding with considerable rapidity. The excavations are nearly finished at the foot of Primrose-hill, and the clay which had been removed from that quarter is used for the purpose of making the embankment necessary to elevate the road near the Regent's Canal. It is calculated that the first twenty miles of the road will be finished within two years, and that the whole line will be completed in four.—*Birmingham Journal.*

One of the difficulties which has hitherto attended the construction of rail-roads is the establishment of a sufficient foundation for the iron rail, which has been usually laid on a sleeper of granite or other stone, and sometimes on wood. But the expense of these materials have been found so enormous, that it has been suggested to substitute for them slabs of slate, fixed in a bed of concrete. In order to ascertain the best mode of effecting this object, it has been arranged that 300 or 400 yards of the Birmingham and London Rail-road shall be laid with slate sleepers in the first instance.—*Ibid.*

We have heard with much regret of the death, on the 20th instant, of one of our mathematical correspondents, the Hon. Lionel Smythe, second son of the Right Hon. Viscount Strangford. He was a youth of extraordinary promise; for, though he had not quite completed his thirteenth year, he was already not only a good mathematician, but well advanced in every other branch of polite learning. Two excellent mathematical solutions from his pen will be found in this Journal, No. 513, p. 156 and No. 551, p. 361. He was as amiable too as he was clever; and though one of the foremost amongst those of his age and station in all useful and elegant pursuits, was at all times one of the most gentle, modest, and unassuming.

Communications received from Mr. Squire—Q.—Mr. Aris—R. S.—William.

The Supplement to Vol. XX., with a Portrait of William Symington, is now ready, price 6d. also Vol. XX., complete, in boards, price 8s.

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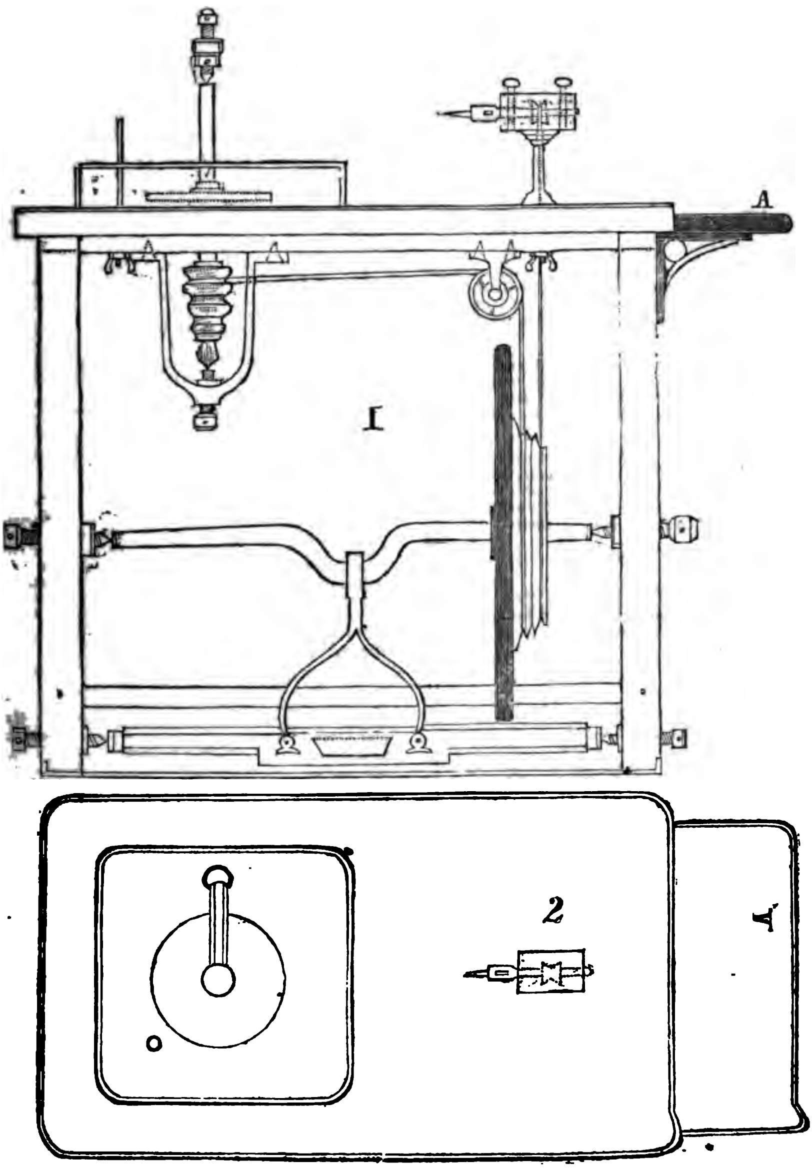
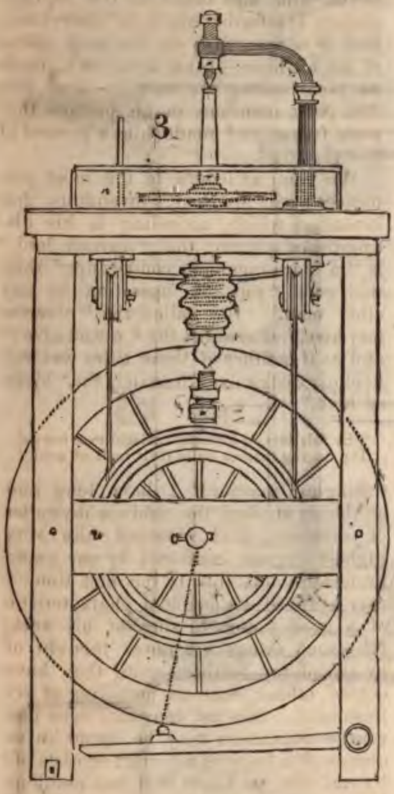
No. 573. SATURDAY, AUGUST 2, 1834. Price 3d.

LAPIDARY'S UNIVERSAL LATHE.



LAPIDARY'S UNIVERSAL LATHE, FOR CUTING, GRINDING, POLISHING, &c.

Dear Sir,—The sketches which I send you herewith, represent a foot lathe, which I recently made for a gentleman who is fond of mineralogical pursuits, and who not only works occasionally at it himself, but employs a good workman to do all sorts of lapidary jobs for him. The drawings (fig. 1, a front elevation; 2, plan of the top; and 3, end elevation) are



on a scale of one inch to a foot, and show the construction of the apparatus so clearly, as to stand in need of but little explanation. It combines, you will observe, not only the usual arrangements for cutting, grinding, and polishing, but those required for seal engraving, and is at the same time extremely compact and *manageable.*

The frame is entirely of ash, done over with varnish of a yellow tinge, and looks nearly as well as satin wood. The foot-wheel is a light casting of iron, with a lead ring cast on, and then turned and varnished black; it has six laps, each fitted with its spindle and pulley. The crane neck which holds the upper centre is of brass. The seal engraving or drilling head may be worked by sitting on the opposite side; as academician or amateur turners work with the lathe head to the right hand side, and not to the left hand side like commoners. The ring that carries the cat-gut band for driving is of mahogany. The part marked A is that which holds the cushion for the elbow to rest on.

The cost of the apparatus was from 12*l.* to 14*l.* I am, dear Sir, &c.

WM. REED.

Peterhoff, April 17, 1834.

SOME MORE NOTES ON MR. NUTT'S BOOK ON BEES.

Sir,—In consequence of your inserting in your Magazine my remarks on Mr. Nutt's book, I am emboldened to continue them;* but in doing so I shall endeavour to be as concise as possible.

We are told (p. 95)—"on rising early one morning in July, 1827, and walking into my apiary, as my custom then was and still is, I found that some malicious wretch had been there before me, and overturned a fine colony of bees." Is it not possible that the fine colony of bees, by being placed, as we are informed they were on a square box, toppled off (to use an expression of Mr. Nutt's) of their own accord, without the assistance of "the malicious wretch?" Sir Joseph Banks, if Dr. Walcot can be relied on, was once the occasion of a similar accident when engaged in some interesting entomological pursuits.

Mr. Nutt, with "invention ever new," immediately converts the malice of this "malicious wretch" into a great benefit, for it leads to the invention of a bee-hive at least equal in value to his "matchless one." It is called the inverted hive, though, to a plain bee mas-

* We think our correspondent's remarks are written in the spirit of truth, and therefore willingly insert them; which we do the more readily, that though ample time has been afforded to Mr. Nutt and his admirers to refute the former strictures of the same writer, they still remain unrefuted in every essential particular—the friendly efforts of Mr. Booth and K. notwithstanding.—ED. M.M.

e myself, to turn a beehive topsy-appears an absurdity. Indeed Mr. when enumerating his objections practice of driving bees, acknow- it to be so. He says they are topsy-turvy, and describes it very s a "strange unnatural position," when descanting on the merits own invention it becomes instanter ry best possible position. Mr. must, however, have overlooked nconvenience arising from it—at o it appears to me. The cells in mb, as built by the bees in the have an inclination so great as to of being completely filled with without requiring to be sealed ax, which is never done, except- e honey is intended for use in . By turning the hive topsy-turvy, his unique invention, if there be ney in the cells at the time the on is performed (which is ex- y probable, as it is recommended one between the months of March ctober), every drop will run out, dging at the bottom of the hive, obably destroy the greatest part bees, and those not absolutely will be so daubed with it, as never be able to fly—an objection, by y, which Mr. Nutt avails himself d strenuously urges when con- g the storying practice. There is r very powerful objection to this rvy hive, which must be obvious y one. When a hive is placed, as lly is on a stand, by carefully it on one side the stand can be cleaned (which Mr. Nutt very y recommends to be frequently but how is such an operation to ormed when the hive is turned rvy? It is impossible. Every ust fall to the bottom of the hive, t will accumulate and become an ble nuisance, there being no made of any semi-lunar hole which the filth might be ex- Besides these objections, the of fitting up one of these topsy-ives must be so enormous as to balance any advantage to be de- m it. The only part after all invention to which Mr. Nutt has im is the topsy-turvy part — relates to *the glasses* is entirely *ntion of the late* Mr. Wildman. *sed some years ago,* at the shop of Mr. Wildman, just above Middle-row, Holborn, a straw hive, with a flat wood top to place glasses on, with proper apertures cut for the bees to work through into them, exactly as I understand to be the case in Mr. Nutt's inverted hive; and I now get excellent straw hives, made in a similar manner, at a less price than 4*s*. There are boxes made on the same construction, I believe, by Mr. Milton, of Marylebone-street, who also furnishes the requisite glasses. It is farther worthy of observation, that Wildman gives in his book plates of all his hives—*these hives with glasses on them among the number*—and that Mr. Nutt mentions in his preface that some friend had made him a present of this very book.

We come at length to the most prominent of all Mr. Nutt's inventions, that invention which, according to his distinguished patron, the "learned lord," is "a more ingenious contrivance" than was ever "put into operation by any other man." It is called the "observatory hive," afterwards the "grand hive;" and as if neither of these titles was sufficiently distinctive, ultimately the "blessed hive."

> "By this bless'd hive our ravish'd eyes behold
> The singing masons build their roofs of gold."

"Singing masons!" I have long and anxiously studied the sublime mysteries of masonry, and obtained the very highest degrees conferred by our grand professors; but this is the first time I ever heard of its being a characteristic of a good mason to sing at his work. No—such things are never thought of by any of my brethren until they have ceased labour, and are partaking of refreshment. I do not deny that some unworthy characters may be found in so numerous a body as my craft consists of. By tradition we know that two pestilent fellows were engaged in the building of Solomon's Temple, and the atrocious act they committed is still deeply deplored by all good masons. I apprehend the idea that masons mis-spend their time in singing was communicated to Mr. Nutt by his noble patron the "learned lord," who, from his acquaintance with the ancient authors, has no doubt read the following story, which is to be found in *Thomas* Bozius de Signis Ecclesiæ:—"How certaine theeves, having stolen

the silver boxe wherein the wafer gods used to lye, and finding one of them there, being loth, belike, that hee should lye abroad all night, did not cast him away, but laid him under a hive: whom the bees acknowledging, advanced him to an high roome in the hive, and there in stead of his silver boxe, made him another of the whitest waxe: and when they had so done, in worship of him, at set houres they sung most sweetly beyond all measure about it: yea, the owner tooke them at it at midnight, with a light and all. Wherewith the bishop being made acquainted, came thither with many others; and lifting up the hive, hee saw there neere the top a most fine boxe, wherein the host was laid, and the quires of bees singing about it, and keeping watch in the night, as monkes doe in their cloisters. The bishop, therefore, taking the host, carried it with the greatest honour into the church: whither many resorting, were cured of innumerable diseases." The conclusion which the author necessarily inferreth thereupon is better than all the rest:—"*Ex his necesse dicamus in eucharistia verum Christi corpus esse.*"

This "blessed hive," Mr. Nutt observes, "*at first sight*, may probably appear a piece of complicated machinery." But what at second sight? I will venture to answer for every person who has read or may read Mr. Nutt's description —"just as complicated as before!" I have read the description of every steam-engine which has appeared in the Mechanics' Magazine ever since its first publication, and, with the assistance of the accompanying plates, could always understand the machine described as well as a person not being a professed or scientific mechanic could be expected to do; but although I have read the description of the "observatory hive" ten times over, I am still as much in the dark as to what constitutes its peculiar excellence, as I was before I possessed Mr. Nutt's book. I am almost tempted to believe Mr. Nutt did not intend that the reader should understand his description; it has certainly as much the air of a deliberate piece of mystification as any thing I ever met with. I must, however, return my thanks to Mr. Nutt *for one piece of information* he has given *of great importance*, which is, that in *writing the description* of this "grand," this "blessed" hive, he did not consume the midnight oil, but used "a *tallow* candle of his *own* making, stuck in a *telescope* candlestick, with a *square* foot!"

The directions for stocking with bees this observatory hive are too diffuse to remark on; but I cannot avoid noticing the pertinacity with which Mr. Nutt maintains his assertion, that two hives of bees will quietly unite on being put together, and become as one family. The observatory hive, in summer, consists of two distinct families—one inhabiting the topsy-turvy part, and the other what is properly the observatory or part to peep into. A piece of mechanism resembling the telescope candlestick, used by Mr. Nutt when writing the description of it, keeps the two families completely separated during the summer; but on a slide being withdrawn in the autumn, the bees in the observatory part are said to quit their summer residence and join their topsy-turvy neighbours, who, strange to tell, quietly unite with them: the united bodies continuing henceforward, according to Mr. Nutt, to labour as one family. I have before observed, and again repeat, that they will do no such thing without fighting. Their combats, in such cases, are carried on with all the animosity of two hostile tribes of Indians—a fact well known to every person who is the least acquainted with the habits of bees.

The only farther notice I shall take of Mr. Nutt's "grand" or "blessed" hive, is to mention that the thermometer, which he had previously taught us to believe was an indispensable instrument in the humane management of the honey bee, is dispensed with in this as well as in the topsy-turvy hive. Are we to infer from this that it is a matter of no consideration whether the bees in either of *these* hives are treated humanely or not?

I am now come to the chapter on fumigation, which appeared in the Mechanics' Magazine, by which I was enabled, previously to possessing Mr. Nutt's book, completely to demolish every pretension he could possibly have to call himself the discoverer of that process, although he arrogates to himself all the merit of it. I refer to my letter inserted in the Mechanics' Magazine of the 11th Jan. last, in which I proved that he had copied the whole of his directions how to perform the operation, verbatim, from the work of Mr. Thorley, which no other

n, to use the language of the learned "save Mr. Nutt," would have done, ut mentioning the source from e he obtained the information. is is not all.

m now able to prove that fumi- bees was a common custom 150 before even Mr. Thorley wrote his I possess an elaborate work, writ- that profound scholar and learned ian, Dr. John Gerard, called his bal," my edition of which was d in 1597, and I shall extract from t is said respecting the very fun- Ir. Nutt uses for his *newly* dis- d process of fumigation. From will appear that Mr. Nutt and his n pupils, both patrician and cleri- ave been using a very dangerous . The doctor's words are:—"It lled fungus orbicularis, or lupi us; some do call it fungus lucer- , in English fusse balls, pucke and bull fists, which in some of England they use, being set on kill or smolder their bees when vould drive the hives, and bereave or bees of their meat houses and for which purpose it fitly serveth. rm they are very round, sticking leaving unto the ground, without alks, at first white, but afterwards luskish colour, having no hole or in them whereby a man may see hem, but being trodden upon do forth a most thin and fine pow- ike unto smoke, very noisome to es, causing a kind of blindnesse, is called poore blinde or sand ; for it has been often seen that have been blinde ever after, when ll quantity hath been blown into ies."

Nutt, at the commencement of th chapter, admits that, in the pre- one, he had been to sea without a —the meaning of which nautical , if I understand it, is that he had vriting on a subject of which he tirely ignorant; an admission which ght have made with equal pro- at the commencement of every r in his book. The opinion which tertains, that the old queen bee her hive with the first swarm, I t myself entertain, although Dr. does; but as the doctor, in his *n bees, makes no mention* of hav- *de any experiment* himself to ascertain the fact, I do not feel bound to pay much attention to the doctor's dictum, although I entertain a high respect for him. Mr. Nutt has evidently borrowed the idea from Huber, whose work on bees was translated into English so long ago as 1808; and although he has positively asserted that he never obtained any knowledge of bees from books, many persons like myself will be incredulous, knowing he could avail himself of the discoveries of Huber twenty-four years before his own book was published. My incredulity is increased by the praise he lavishes on the discovery of Shirach, which he tells the learned lord he had proved satisfactorily to his own mind, although, from his ignorance of every thing respecting the true economy of bees, I believe him incapable of performing such an experiment. I was convinced he had read Huber when I first addressed you; and when I knew nothing of his book but through the medium of the Mechanics' Magazine, by his using the following expression—"how is the queen bee impregnated?" which is copied from Huber. Mr. Nutt describes the queen's leaving the hive as follows: —"She leaves the *royal cradle impregnated* with the royal larvæ, and withdraws from the hive, unwillingly, no doubt." If there be such a degree of unwillingness on the part of the old lady to withdraw from the hive, why does she not wait a few days, when, if I understand Mr. Nutt's expression, the impregnation of the royal cradle would have arrived at that stage which, by accoucheurs, is called parturition, which would have obviated the necessity of the journey? The laborious experiments of Huber, to ascertain whether the old queen departed from the hive with the first swarm, were undertaken at the suggestion of the French naturalist, Bonnet, to whom all Huber's letters detailing the result of them are addressed. Bonnet, in a very long letter which he wrote Huber at the time, urged him in the strongest language never to mutilate the queen, but to mark her on the thorax conspicuously, with a varnish that would resist humidity, and produce no injurious effects. This advice Huber, however, pertinaciously rejected; for, in every experiment he gives an account of, he invariably deprived the queen of one of her antennæ. Now, Bonnet, in giving such advice to Huber,

must have been well aware that by mutilation the habits of the insect would be altered; indeed it is so, if a creature is only deprived of a limb—how much more, then, when deprived of such an important organ as the antennæ, which he allows are either the organs of feeling or smelling. He admits, also, that depriving a queen of *both* antennæ was productive of most singular effects. From the moment of its being done, there was a very great alteration in her conduct; she was sometimes quite motionless, at others she traversed the combs with great rapidity, and if she wanted food from the working bees, she directed her trunk for the purpose of receiving it with an uncertain kind of feeling, sometimes towards the bees, and sometimes against the combs; and if her trunk did reach the mouths of the bees it was by chance. She also appeared tormented with a desire to leave her habitation, and he found it impossible to keep her in the hive: neither would the bees follow her in this mutilated state—indeed, they appeared perfectly indifferent what became of her. If this be the consequence of amputating both the antennæ, why then persist in mutilating the insect at all, particularly when in direct opposition to the advice of the person for whose satisfaction the experiments were undertaken? If such effects were produced by depriving the insect of both antennæ, is it not natural to suppose that the amputation of even one must produce some great alteration likewise in the insect's conduct, such as being tormented with a desire to leave the hive? I am convinced it does create this desire, and that it is carried into execution the first moment she can induce a swarm to accompany her. My opinion is strengthened by what Huber says, that his bees always swarmed when he had no expectation of their doing so; for it always happened after his secretary and himself had been engaged in experiments with them, and had gone away. I never shall be of Huber's opinion, until I hear of a series of experiments conducted in the manner suggested by Bonnet, and attended with similar results to those recorded by him. He admits that when in a perfect state, the bees will never allow, for any length of time, more than one queen to remain in a hive, in *consequence of the mutual animosity that exists between them*; although when deprived of one antennæ each, they will permit two, and the queens cease to retain their usual enmity to each other.

It is absolutely astonishing with what facility Mr. Nutt, according to his own account, has been induced to adopt the idea of the old queen leaving her hive with the first swarm, for the following is an account of the whole of his researches on the subject:—He has, he says, sometimes on the evening a hive has swarmed—sometimes on the second, at other times on the third evening afterwards—fumigated the hive, dissected and examined the combs and queen cells minutely, and whenever he has found a queen it has always invariably been a young one; but in general he has only found a royal cell, just ready as it were to give birth to a successor to that which had left the hive. In this easy and expeditious way does Mr. Nutt solve a problem, which occupied the indefatigable Huber and his equally indefatigable secretary many years. Even in this experiment, as it is called, trifling as it is, he is incorrect. He says, the queen withdraws from the hive, leaving the royal cradle only impregnated. I once had a swarm that settled on a post, and in hiving it the queen was killed; the bees in consequence returned to the hive. The same evening the usual noise, which is made before a second swarm, was made, and I distinctly heard it from different parts of the hive at the same time: a proof, that instead of the royal cradle only being impregnated, there were two queens actually then in existence; the hive swarmed early the next morning. Reaumur, who studied the habits of bees many years, and is called, from the great knowledge he acquired of the insect, the historian of bees, did not believe the old queen left the hive; and Huber admits he never in any other instance found him inaccurate. An ancient author, named Publius Virgilius Maro, has recorded his opinion against Mr. Nutt very decidedly in the following words, as rendered by Dryden:—

> "The youthful prince, with proud alarm,
> Leads out the vent'rous colony to swarm."

The same author informs us, that the evil of bees swarming, which Mr. Nutt now so feelingly deplores, existed in his time, and recommends, when such a distressing event occurs, to mix with tink-

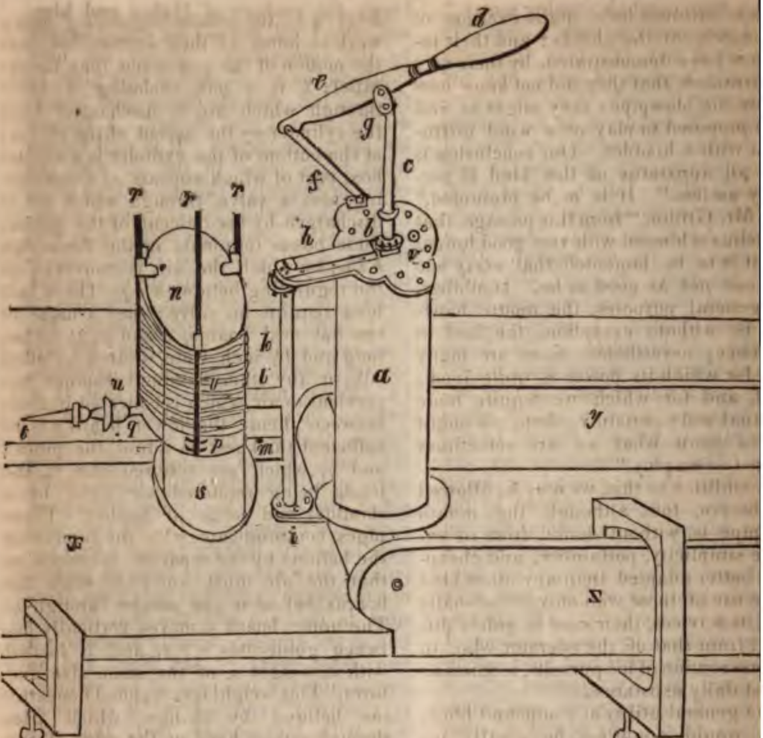
ling brass "the cymbals droning sound;" and as I am resolved such a laudable practice shall not fall into desuetude through any neglect of mine, and not possessing any cymbals, I use an instrument, probably unknown to my ancient author, ycleped a warming-pan, which I find, from experience, answers the purpose equally well. Butler, whose work, the "Feminine Monarchie," was translated into Latin in 1671, believed a young queen led the first swarm. John Geddie, Wildman, Bonnor, Mr. John Hunter, and many other authors, were of the same opinion. I do not possess the works of Aristotle or the Elder Pliny, and therefore cannot avail myself of those great authorities. It very frequently happens, when a swarm issues from a hive it returns almost immediately. This is occasioned by the queen falling to the ground, or being unable to fly. On being missed by the bees they return, and in general she can easily be found on the ground with a small cluster of bees surrounding her; and if examined, she will be found to be a young one unable to fly. The circumstance is noticed by many authors—I know even of instances that have occurred this year. Mr. Nutt appears to be of opinion that the queen is an amalgamation of both sexes. He doubts whether there is any male bee, and says the fact is the queen is both virgin and mother; although, according to his own book, the queen carries on the business of procreation in what he calls the Pavilion! Afterwards he says there is no copulation. If I understand any thing of my own language, both words have the same meaning. When the learned lord asks him how generation was brought about, he finds himself at such a nonplus as to be incapable of an answer, but turns the discourse, and says he is confident neither drones nor working bees lay eggs. No person supposes the drone does; but Huber is of opinion that there are fertile working bees. Mr. Nutt says that even the indefatigable Huber never discovered the precise way in which the queen bee was impregnated, but imagined it took place in the air, and that he MODESTLY acknowledged he never witnessed the act of copulation. Mr. Nutt should have omitted applying the term *modest* to such a man as *Huber, for there* may be persons who will draw a comparison between the modesty of Huber and himself, and I will not say he would benefit by the comparison. Huber not only supposed the act of coition took place in the air, but that the drone died immediately after it was effected. I believe his ideas are correct. It is well known what takes place in the air with the common housefly; the same thing takes place with the white butterfly and the common mayfly. The male of the latter dies shortly after coition, as Huber conjectures is the case with the drone; for the effect is the same as when a bee uses its sting, death being the consequence. Mr. Nutt makes strange assertions; he says the royal larvæ are *always* in existence. In another place he states that if it were not for the great heat caused by the drones, that are never seen but from May until the end of August, the young larvæ of all the bees would undoubtedly perish. But how do the drones themselves come into existence? In the very next page he asserts, that the bees of a well populated hive will always bring to perfection the queen's eggs that have been deposited in the cells after the total destruction of the drones. Shortly afterwards a new light opens on Mr. Nutt, and he now doubts the accuracy of his opinion, so positively expressed in his conversation with the learned lord, that the queen bee was both virgin and mother. In short, he says, "I now see no objection to Huber's theory, although there is no direct proof of the copulation of the queen with the drone." All apiarians agree—indeed it is impossible to deny—that there are male and female in a hive of bees. Mr. Nutt very shrewdly observes, that although no person has ever observed the act of coition, it is, no doubt, performed in a way consistent with the law of nature—a very candid admission.

It was my intention to have made some remarks on Mr. Nutt's pretensions to entomological knowledge, but find, on a careful perusal of his book, that he is absolutely ignorant of every part of the science. I now close my remarks on his book, requesting your acceptance of my grateful acknowledgments for the insertion of them in your very useful Magazine.

I am, Sir, yours, &c.

J. P. T.

June 24, 1834.



DESCRIPTION OF A NEW PORTABLE BLOWPIPE.

For the more elaborate operations of chemistry and mineralogy, the gas blowpipes of Dr. Clarke and others are, doubtless, from the intense heat they are capable of affording, the best in existence; but as these instruments are highly dangerous in the hands of any but scientific and experienced practitioners, they are totally inapplicable to the use of working artisans. For their purposes, moreover, so powerful a heat is neither necessary nor desirable. The common blowpipe, of which the blast is usually raised by a stream of air from the lungs, is that chiefly in use among artificers. Some, however, in consequence of the fatigue and injurious effects necessarily arising from frequent and lengthened manipulation of this instrument, have followed the example of the glass-blowers, and adopted the use of bellows. That the use of the common blowpipe is fatiguing and perni-*cious, especially in long* operations, must *be perfectly clear,* although persons well skilled in it may not experience injury. Speaking of the hydrop tic blowpipe, Dr. Clarke states its advantages to be "the relief afforded from that *fatigue and po of injury to the lungs*, incident tracted restraint on their free a which persons using the *commo blowpipe* were liable." Mr. Gri other writer on the blowpipe, tells the glass-blowers' table is reso "when it is required to continue of the blowpipe so long as w *fatiguing if the breath merely w ployed.*" This point is indeed suff attested by the numerous contr already brought forward for mo diminishing, or entirely supersedi labour of the lungs. Berzelius, th champion of the mouth blowpi however, taken up a sweeping o against every thing of the kind. these pretended improvements," "motions more or less troubleso

been substituted for a slight exertion of the muscles of the cheeks; and their inventors have demonstrated, by their very contrivances, that they did not know how to use the blowpipe: they might as well have proposed to play on a wind instrument with a bladder. Our conclusicn is that all apparatus of this kind is perfectly useless." It is to be presumed," says Mr. Griffin, "from this passage, that Berzelius is blessed with very good lungs; and it is to be lamented that every one else has not as good as he. Doubtless, for general purposes, the mouth blowpipe is, without exception, the best in existence; nevertheless, there are many uses for which its power is quite inefficient, and for which we require more effectual aid: certainly, then, we ought not to scorn what we are sometimes obliged to employ."

In addition to this, we may be allowed to observe, that although the mouth blowpipe is, without doubt, from its extreme simplicity, portability, and cheapness, better adapted than any other kind to the use of those who only occasionally need its services, their case is widely different from that of the operator who, in the prosecution of his pursuits, requires its almost daily assistance.

The general utility of compound blowpipes would, doubtless, be greatly increased, did they subjoin to their other qualifications that of portability. The glass-blowers' bellows, with its table, forms a bulky machine. Toft's valuable hydro-pneumatic blowpipe, though sufficiently portable to be readily removed from one room to another, can by no means be carried about the person. The no less ingenious apparatus of Mr. Tilley is similarly circumstanced. In short, there is not, as far as I am aware, any instrument of this class portable enough to be termed a "pocket blowpipe." The construction of such an instrument for the use of practical men, was the object of the present attempt, and the accompanying sketch will explain its formation and principle of action.

It consists principally of a flexible reservoir or bellows, into which air is conveyed by a double forcing pump. Let *a* be a small cylinder, 3 ¾ inches in length, and 1⅜ inch in the bore, in which a solid piston works air tight; *b* an air *tight collar or stuffing-box,* through *which c the piston-rod is* propelled by the lever *d e*: the connecting-rods *f* and *g* work in joints at their extremities, that the motion of the piston-rod may be parallel; *h* is a box enclosing a valve through which air is discharged from the cylinder by the ascent of the piston; at the bottom of the cylinder is a similar box, part of which appears at *i*, containing also a valve, through which air is discharged by the descent of the piston: these boxes terminate in the force-pipe *k l m*, by which the air is conveyed to the regulating bellows *n o p*. These bellows require no valve; they consist of two flat oval boards, *n* and *p*, 2½ inches long and 1½ inch wide, united by oiled silk, or any other flexible substance impervious to air, which is collected in folds between them: the lower board *p* is of sufficient thickness to admit the pipes *l* and *q*, which are screwed into it, the joints being rendered air tight by a shoulder and collar of leather. These pipes communicate with the interior of the bellows by the separate apertures, so that the air must enter between the boards before it can escape through *q*. The upper board *n* moves vertically between guide-rods *r r r*, and is loaded with a weight *s*, of the same size and form. This weight is suspended beneath* the bellows by strings, which pass through staples fixed in the edge of the board *p*, and are finally attached to *n*. The air propelled through the force-pipe by the pump, is thus discharged in an unintermitting and regular stream from the jet *t*: *u* is a ball and socket joint, by means of which, as in Newman's apparatus, the jet may be turned in any direction. For the admission of air into the cylinder, two valves, the upper of which appears at *v*, are provided. The intensity of the blast may be regulated by a stop-cock at *q*. The case *w x y z*, which forms the stand when in use, is a box about 7 inches in length, 3 in breadth, and 2½ in depth. It is fur-

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* For this arrangement I am indebted to the suggestion of a scientific and learned friend. The action of the regulator is certainly circumscribed, since by this alteration the descent of the weight is confined to a certain space, which clearly would not have been the case had the weight, according to my original intention, been placed *upon* the board *n*. The action of the regulator is, however, in other respects *greatly* improved; while the objection above mentioned may be sufficiently obviated by placing the pipe *l* nearer to *k*, which will give to the weight an increased space of descent as great as can well be required.

nished with a strong cylindrical hinge, to which the forcing pump is attached by a thick screw at the bottom of it. The box is fixed to the table by a couple of clamps. When disused, the lever *d e* and connecting-rod *f* are detached from the pump by drawing the screws at their joints; the piston driven to the bottom of the cylinder; the guide-rods *r r r* removed from the regulator; the pump *a* separated from the hinge of the box, and from the regulator; and, together with the aforementioned parts, laid lengthways in the case; the pipe *q*, with the jet *t*, is then detached from the regulator; the boards of which, together with the weight *s*, are laid close together and placed crossways in the box; the clamps, jet, and ball and socket joint, are also accommodated; and thus the whole apparatus, exclusive of the lamp,* is brought within a compass adapted to any man's pocket. The lid of the box, which has edges about half an inch deep, may be lined with tinned iron or thin sheet brass, by which means a small tray, very useful, in many cases, for catching particles falling from the body operated on, will be provided.

However this contrivance may surpass the glass-blowers' table, and other instruments above-mentioned, in portability, it must in justice be confessed to fall below them, inasmuch as they leave both hands at liberty. This, however, is an advantoge which cannot reasonably be expected in so portable an apparatus; and the common mouth blowpipe, which is now and always has been in such general use, lies open to the same objection, and in a still greater degree: for that instrument cannot leave the operator at liberty even for an instant; whereas this, in consequence of the reservoir, when fully inflated, being capable of continuing the blast for a few seconds without the aid of the pump, will allow, in many instances, time sufficient for relieving the hand, adjusting the work, &c.

To the mineralogist the blowpipe, Mr. Griffin observes, is "an instrument of *indispensable utility*;" but the want of portability in the bellows and others renders them, as he afterwards remarks, "less useful for mineralogical researches" than they otherwise would be. Although none can vie with the mouth blowpipe in this respect, it is to be hoped that the objection is here so far removed, that the mineralogist as well as the artist may find it applicable to his purposes.

Notwithstanding this instrument is intended to be worked with atmospheric air, there is no reason why it should not be used as an oxy-hydrogen blowpipe. Thus the regulator *n o p*, will serve the purpose of the gasometer of Mr. Gurney's apparatus.* The safety apparatus employed by him may be attached to the pipe *q*, and the suction valves connected by flexible tubes with the transferring bladder. The gasometer may thus be charged from the bladder without the aid of an assistant, so that his services may be dispensed with.

Some few directions should be observed respecting the manipulation of this instrument. 1st, The operator, when working the lever *d e*, should bear rather toward the connecting rod *f*, otherwise he may bend the piston rod. 2d, The piston should be propelled with regular and uniform strokes of a moderate velocity; that velocity being somewhat less at the commencement of the stroke than subsequently. This will render the blast regular. 3d, The operator should keep the regulator nearly full of air (observing, at the same time, *not to fill it to excess*). By this means he will be in a situation to use both hands for some seconds, should any thing suddenly require it. A short practice will so establsh the habit that he will work the instrument with the requisite accuracy, keeping his eye at the same time fixed upon his object.

STEAM NAVIGATION TO INDIA.

1. *Report of the Select Committee of the House of Commons.*
2. *Observations on the Advantages and Possibility of successfully employing Steam Power in Navigating Ships between this Country and the East Indies.* By Messrs. J. and S. Seaward.
3. *Appendix to Observations.* By Messrs. J. and S. Seaward.

The Select Committee of the House of Commons, appointed to inquire into the

* The lamp may be enclosed in a box, and carried in the pocket.

* See Griffin's Treatise.

best means of establishing a regular steam communication with India, have, as we stated two weeks back, reported in favour of the route by the Mediterranean, Euphrates, and Persian Gulf, in preference to that by the Nile and Red Sea, and recommended that 20,000*l.* should be appropriated to assist in defraying the expenses of giving it a fair trial, which sum has accordingly been voted.

The purpose of the pamphlets by Messrs. Seaward, is to show that no Mediterranean line that can be adopted is so well calculated to effect the end in view—taking it in all its bearings—as the usual route of our merchant Indiamen by the Cape of Good Hope; and this position, we think, they have established so satisfactorily, and with so much professional ability, that we need do little more than place their reasons for it in a succinct form before our readers.

The preference shown, both in India and at home, for what, speaking generally, without reference either to the Persian Gulf or Red Sea line, may be called the *South-East Passage to India*, seems to rest entirely on the fact that it is from 4,000 to 5,000 miles shorter than the route by the Cape of Good Hope. But if this abbreviation of the distance be an advantage of such paramount importance, how comes it that the south-east passage was ever abandoned? It formed the ancient route to India, before Vasco de Gama pointed the way round the Cape; but no sooner had that adventurous mariner established the practicability of a south-west passage by sea throughout the whole distance, than it was universally adopted, to the exclusion of the ancient route, though about two-thirds longer. Does not this of itself show that there must be other circumstances, besides mere linear distance, which enter into the account, and that, at one time at least, they were thought of much greater importance? And does it not raise a strong presumption against the wisdom of the attempt which is now making to drive commerce back into its ancient channels?

The principal drawbacks to which the south-east passage are, and must always be, subject, are these:—

1. The passage must, *of necessity*, be *divided into four independent stages*: the *first being from England to the Mediterranean; the second up the Nile* or Euphrates, as far as navigable; the third overland; and the fourth from the Red Sea or Persian Gulf to India. For these four stages three different steam-vessels and one caravan would be necessary, which would require of course as many separate loadings and unloadings, attended with great certain inconvenience, and much risk of waste, demurrage, &c.

2. It is necessary, by this route, to traverse for 500 or 600 miles the territories of foreign potentates, over whom no company of British merchants, not even the British Government itself, could be supposed to have more than a conventional influence, liable at all times to be defeated by the machinations of rival powers, or the caprice of these potentates themselves. It would be a practicable route as long as the Pacha of Egypt, or whoever may succeed him in his precarious sway, chose, but no longer.

3. Admitting that the Pacha and his successors were to exert all their influence to protect this line of traffic, it must, at all events, be on the principle of making something by it.

"It is too much to expect that he would do all this without taking care to secure for his own country some important advantages. Our steam-ships will have to pay port charges, and other dues, in the port of the Mediterranean and of the Red Sea; and the passengers, their luggage, as well as bags of letters, will be heavily taxed, in some way or other, for permission to traverse the country; not to mention the restrictions of police, &c., which will be necessarily imposed on the transit of passengers by this route."—*Appendix to Observations*, p. 53.

4. The passage by this route would be liable to frequent interruptions from circumstances, which not even the strongest local government could control. As often as the plague broke out, as often would a stop be put to the traffic.

5. The south-east passage must always be limited to passengers (and these of the better sort), letters, and despatches.

"It can never be adopted for the transit of merchandise and conveyance of troops—it can only be made available for the journey of passengers and their luggage; but even among passengers travelling to and from India, there is a very large class for whom this route, we think, would never be proper: this class consists of women and children, and invalids, whom the apprehension of the dangers attending a journey through Egyp

would most surely deter from making choice of that line and mode of travelling, consequently three-fourths of the profitable investment of a steam-ship would be entirely cut off by adopting this route."—*Ibid*, p. 60.

6. Supposing every thing to turn out as favourably as possible for a passage by this route, it could not be accomplished in less than about 52 days, which, according to Messrs. Seaward, is only 20 days less than a passage by the Cape might be accomplished by steam (of which more presently), though more than twice the time usually occupied in the sailing voyages to India.

The south-east passage has never yet (we believe) been effected in nearly so short a period as 52 days; while sailing voyages round the Cape have been accomplished in much less than 104. We know one case (that of the Boadicea, private trader) in which the voyage was performed in 89 days, all stoppages included; and there have been several instances of despatches that were forwarded, *via* Egypt, arriving in London a week or two after vessels which sailed from India at the same time. It may be said that the south-east passage has not yet had a fair trial, owing to the incompleteness of the existing arrangements; but though there is doubtless much truth in this, we may fairly ask, on the other hand, how long can we depend on having so vigorous a protectorate as that of Ali Pacha?

And, 7. The south-east passage must, under any circumstances, be excessively expensive. Messrs. Seaward seem willing to concede (*Appendix*, p. 64,) that passengers (though not goods) could be conveyed by this route as cheaply as by the Cape of Good Hope. We see nothing, however, to warrant such a conclusion. It is, on the contrary, quite certain that to go at present by the Red Sea to India costs from three to four times more than it does to go by the Cape; nor is there any likelihood that this expense could be very much reduced, even by greatest possible improvement in the existing arrangements.

Let us now see what Messrs. Seaward have to offer in favour of going round by the Cape.

1. By this route there is an uninterrupted and uninterruptible water conveyance the whole way; but one embarkation and disembarkation. We are complete masters of the highway, and there is no one to oppose us either by imposts or by restrictions of any sort.

2. The voyage, which now occupies, on an average, from 100 to 130 days, may, by the employment of steam-ships, be certainly effected within the short space of 70 days.

There have been two attempts already made to employ steam on this route, both of which have proved decided failures; but it is only necessary to peruse the following very interesting details on the subject, to be satisfied that it was not the steam which was at fault in either case:—

"The first attempt to navigate a vessel to India by steam was made about nine years back. At that time the Enterprise steam-ship was fitted out in London, at an expense of about 40,000*l*. This vessel, of 470 tons, register measurement, was furnished with engines of 120-horse power, and no expense was spared to fit her for the voyage, in what was thought to be the most complete and efficient manner; nevertheless, the primary object of the speculation was not accomplished, for although the vessel reached India in safety, yet the time occupied in going was nearly as long as that required for an ordinary sailing vessel. The proprietors, however, were not ultimately losers, as the vessel was sold in India for a sum equal to the full amount of the outfit.

"The causes of failure in the Enterprise steam-packet were very apparent, and can be easily pointed out.

"First.—The vessel was not more than one-third of the size which she ought to have been, consequently she could not take out any thing like an adequate supply of fuel; and the little she did take out brought her so low in the water, that the engines were rendered almost powerless in propelling her forwards.

"Secondly.—At that time the navigating of steam-vessels upon the seas was little known or practised, and although the steam-engine had been wonderfully improved upon, to fit it for marine purposes, the building of steam-ships was little known or studied.

"Thirdly.—The person appointed to the command of the vessel, though a good seaman, was no engineer; he knew absolutely nothing of the machinery, or of the nature of the power which was to transport him to the East. His total ignorance of this most essential qualification required for the mission had a fatal influence on the success of the adventure. From some very erroneous misconception he was induced to steer the vessel a course quite unusual, the consequence was that he met with calms or contrary winds nearly the whole way.

"The other attempt to navigate a steam-

ship to India has been made by the Dutch. It may be here proper to remark, that, although the Dutch nation is far behind this country in the knowledge of most of the mechanic arts, it is nevertheless surprising to observe the astonishing (and to a great extent successful) efforts made by that people, in order to establish a powerful steam marine for warlike and other purposes; efforts which are the more remarkable, when compared to the seeming inattention of our own Government to this important matter.

"About eight years ago the Dutch commenced building the steam-ship the Atlas, intended to run as a regular packet between Holland and the settlements in the island of Java. This vessel is probably the longest vessel ever built for any purpose whatever. She is of the extraordinary length of 230 feet, is 1,800 tons burden, and is furnished with engines of the collective power of 300 horses: altogether, this vessel is a wonderful instance of what can be accomplished by enterprise and perseverance, joined with only a very moderate share of information and experience on the subject.

"It is painful, in a national point of view, to contemplate the probability of the Dutch nation depriving this country of the glory of successfully navigating the first steam-ship to India. That such event will take place, much to the discredit of Britain, there is every likelihood, unless a speedy exertion on our part be made to anticipate the efforts of our industrious rivals. However, the threatened disgrace is not likely to fall upon this country through the means of the Atlas, for after all that vessel has not answered the expectations formed of her: indeed her failure has been of a more decided character than that of the Enterprise, for without very great alterations being made to her, it is probable she will never go to India at all. Having had occasion to be a good deal in Holland, and being well acquainted with the builder and engineer of the Atlas, we had an excellent opportunity of watching the progress of that vessel during her building and completion. We never formed but one opinion on the subject; we never thought she would awswer; and the result has fully verified our prediction. The causes of her failure are very apparent, and which we shall proceed to point out.

"Without knowing any thing of the fate of the Enterprise steam-ship, which had recently been fitted out, the Dutch had sagacity enough to discover the utter hopelessness of being able to navigate, to any profitable purpose, a vessel by steam to India, unless she were planned on a large and magnificent scale: unfortunately, however, their inexperience *led them too far; the proportions which they gave to the Atlas were,* under the peculiar circumstances, as much too great as those of the Enterprise were confessedly too small.

"But the grand cause of the failure of the Atlas must be attributed to the defective quality of the engines and machinery, which are, from first to last, a sad compound of bad arrangements and bad proportions; in fact, the whole machinery displayed in its arrangement the most complete ignorance upon the part of the person who made the designs and plans. The engines were made at an establishment which had been recently formed in the neighbourhood of Liege (an establishment in which, according to the best information, the patriotic Dutch have expended to the amount of nearly half a million sterling, in the sole view of rivalling this country in the manufacture of steam-engines), those of the Atlas being almost the first made in the new manufactory, it is not at all wonderful that they were so defective; the only wonder is that the Dutch should have intrusted the making of such large engines to hands so inexperienced and incompetent. The consequence of this indiscretion is, the total failure of the undertaking as regards any immediate service; for, after repeated trials, the arrangement of the machinery was found to be so defective, and so utterly useless, for any efficient purpose, that the whole has been condemned at an immense loss to the government."—*Observations, &c.,* pp. 8-13.

Messrs. Seaward have two plans, by either of which they conceive the mistakes committed in the cases of the Enterprise and Atlas might be avoided, and a regular steam communication with India, by the Cape, be successfully accomplished:—

"Agreeably to the first plan, we propose that the vessels should be of great length consistent with strength, her burthen to be about 1,200 tons, and to be furnished with a pair of engines of 240-horse power, with all suitable accommodation for passengers and crew; the whole to be fitted up in a plain economical manner, but at the same time on the strongest and most efficient principle. Such a vessel, with her engines, equipments, and every requisite ready to proceed on her voyage, might be fitted out very well for a sum not exceeding 38,000*l.*; being about the same as was expended upon the Enterprise, a vessel about one-third the capacity. This vessel would run upon an average 10 miles per hour, supposing steam to be employed all the way; and as the distance to Calcutta, agreeably to the course adopted by all outward-bound ships, is somewhat under 14,000 miles, the steam-ship will be able to go that

distance in 60 days, to which some days must be added for unavoidable stoppages and delays. When the Dutch fitted out the Atlas, they made her so large, with the intention that she should take a sufficient supply of coals to go the whole voyage from Holland to Java. They have no settlement at which they could touch in their course to get a fresh supply, and not willing to stop at a foreign port, they resolved in this respect to be quite independent. But as regards the British empire, such an arrangement would possess no sort of recommendation, it would be a sacrifice of too many other important advantages for the sake of an uncertain benefit. There are many settlements or friendly ports at which an English steam-ship might touch for supplies in her passage both out and home, without much delay or inconvenience; we should therefore propose that the vessel should take out enough coals for twenty days' consumption only, and to obtain further supplies should stop at any of the following places, which circumstances should point out as being most suitable—namely, the Canary Isles, St. Helena, the Cape of Good Hope, the Mauritius, &c.; at any of which places, depôts of coal or wood should be kept in readiness: these delays would increase the time necessary for the voyage to about 66 days, supposing the whole distance to be run with steam-power, and but little assistance derived from wind and sails.

A supply of coals to enable the vessel to steam for 20 days would be about 480 tons; the weight of the engines, machinery, &c., would be about 180 tons; making altogether about 600 tons: therefore there would still be ample space and tonnage for merchandise, provisions to the amount of 500 tons, and accommodations for 100 to 150 passengers; and as the vessel would be destined for a fast packet, it would not be advisable to increase the whole loading to more than about 1,100 tons, which would still leave the vessel sufficiently light to steam through the water with excellent speed.

"By the second plan of navigating ships to India, partly by wind and sails and partly by steam-power as an auxiliary, we propose that the size of the vessel shall be increased to 1,600 tons burthen, but furnished with engines of the same force as the former, viz. 240-horse power, and to have a supply of 480 tons of coals. This quantity we calculate, supposing her to sail through the trade winds, would be ample to carry the vessel one-half the voyage, consequently it would be necessary to touch at only one port on the passage for a further supply. A vessel of this description would, independent of the *engines and machinery*, coals, &c., carry a *lading of 900 tons of merchandise and provisions, and in that state the steam power* would propel her at the rate of 9 miles per hour through the water; but in this case the steam-power would be only as an auxiliary when the winds were foul, or in the prevalence of calms: for this reason we would recommend that the steam-ship should by no means deviate from the track usually taken by vessels sailing to and from India. By this mode a vessel might be navigated from London to Calcutta in 74 days, with ease and certainty.

"Both the above plans possess their respective advantages—the first has the undoubted preference as regards the shortening the time of the voyage: for a fast packet, destined to convey despatches and passengers, and light merchandise, to form the most expeditious mode of communication with our immense possessions in the East, this plan deserves the first attention; but as regards economy, the second is unquestionably preferrable; for not only may the voyage in that way be accomplished with about half the expenditure of fuel, but the vessel would then be enabled to take twice the quantity of merchandise. By either of these plans, however, it is most certain that a ship might be navigated to India in nearly one-half the time that, on the average, is expended by sailing vessels on the same voyage."—*Ibid.* pp. 18-22.

These views are very ably supported by a minute comparison between sailing and steam vessels, in regard to their first cost and equipment, tear and wear, and number of officers and men required to navigate them. We extract from this branch of Messrs. Seaward's pamphlet the following instructive particulars:—

"We will make the comparison between a steam-ship of 1,600 tons burthen and a sailing vessel of the same tonnage; of course it is conceded that the steam-ship will cost about 6,000*l*. more than the other (it will not be more than that sum, as the size of masts, yards, sails, and rigging, will be reduced one-half), therefore the additional outlay of capital must be compensated for. Again—it is quite certain that the steam-ship will incur a very considerable expense for coals or other fuel; this will amount to about 3,500*l*. per annum, calculating that the steam-ship will make two complete voyages in that time. With respect to wear and tear of machinery, however, no allowance is required; this will be amply compensated by the great saving which will be made in the wear and tear of the sails and rigging. Formerly it was considered that the wear and tear of machinery was so great, and the expense of keeping it in repair so enormous, as to be an insuperable objection

to the introduction of steam-power generally, for the purposes of navigation. Whatever grounds there might have been formerly, in the infancy of steam-navigation, for this unfavourable opinion, it is beyond all doubt that, at the present day, there is no foundation whatever for its being entertained. In sailing ships, the immense wear and tear, and destruction in sails and rigging, is of the most formidable description, and is an evil that nothing can lessen. It may with perfect safety be affirmed, that the loss in this respect is double what it will be in the steam-machinery under similar circumstances. It is true the steam-ship will still require a supply of sails and rigging, but those are not required to be in this case so heavy as in ordinary sailing vessels: thus the masts, sails, and rigging of a 1,600 ton steam-ship need not be heavier than would be usually furnished to a 1,000 ton sailing ship. This alone would be a great saving; but it should also be considered that the sails will not be in requisition more than half the usual time: when contrary winds prevail, the sails will be all furled, and recourse had to the steam power; and it should be remembered that it is during the contrary winds, by tacking backwards and forwards, that the principal wear takes place in sails and rigging."—pp. 33-35.

"It has been supposed by many that the wear and destruction upon the hull of a vessel is much greater where steam power is employed, than when the vessel is navigated by sails and wind. This is a very great mistake, for experience fully proves the contrary to be the fact; indeed, the reason why such is the case is very manifest. It is quite clear that, if a vessel be propelled by any power, whether by wind or steam, the effect of that power will be gradually to weaken and injure the stability of the vessel, and the more irregularly the power operates, the greater will be the injury. Now we know quite well that, in steam-ships, the power is always acting in one uniform manner, and always in that direction which is most favourable for the strength of the vessel, namely, in the longitudinal direction; the very direction, be it also observed, in which the vessel is propelled. Compare this state of things with what happens in a sailing vessel, and we shall find it completely reversed, to the decided disadvantage of the latter. In the first place, the power is communicated to the sailing vessel through the medium of large yards and immense high masts; now consider what must be the dreadful racking and straining caused to a vessel by the immense leverage of these tall masts, &c., *heaving and bearing* the vessel *down on one side: again—how great must be the injury to the vessel, from* the circumstance of the power acting sometimes in one direction, sometimes in another, and almost always in a direction unfavourable for the strength of the vessel, namely, on the beam, or on one of the bows; for it does not happen above once in ten times that the wind acts right astern, which is the only direction that is truly favourable for the strength of the vessel. From the above, which is amply supported by the authority of experience, it is quite manifest that the annual wear and destruction upon the hull of steam-ships is not near so great as it is in sailing vessels."—pp. 35, 6.

It appears, in short, that the only valid objections which can be urged against the employment of steam-ships on the south-west passage to India, is the greater outlay of capital that will be required—about one-sixth more—and the additional expense that must be required for fuel. But—

"As a compensation for these two disadvantages, we have the immense benefit arising from the conveyance of goods and passengers TWO VOYAGES INSTEAD OF ONE. Admitting there would be only the same price charged for a passage to India by the steam-ship as by the ordinary sailing vessels, still the benefit would be of the greatest importance; it would amply remunerate the proprietors for the additional outlay of capital, and for the expense of fuel.,'—p. 39.

"Moreover, the route by the Cape of Good Hope is superior, in a political consideration, as precluding the chances of a portion of the Indian trade being diverted from Great Britain (which might happen by establishing a great line of communication through Egypt); and it is less exposed to interruption by contingent circumstances, while it is every way more worthy to engage the attention of the enterprising and liberal-minded."—*Appendix*, p. 65.

Messrs. Seaward give, at the close of their pamphlet, a brief outline of the sort of steam-ship which they conceive to be best adapted for a voyage to India, and of the measures which should be followed in prosecuting the voyage to the Cape, and thence to Calcutta. Their advice on both these heads is eminently deserving of attention, not only on account of their extensive experience as marine steam-engine-makers, but from the circumstance of Mr. Sam. Seaward having himself made two voyages to India and China, and being intimately acquainted with all the circumstances usually attending an East India voyage.

NOTES AND NOTICES.

Three more days running of Russel's Steam-Carriages:—

Monday, 21st July.

10 o'clock coach	to Paisley	50	minutes.
11	to Glasgow ..	35	..
12	to Paisley	41	..
1	to Glasgow ..	33	..
2	to Paisley	46	..
3	to Glasgow ..	59	..

Tuesday, 22d July.

10 o'clock coach	to Paisley	50	minutes.
11	to Glasgow ..	40	..
12	to Paisley	49	..
1	to Glasgow ..	52	..
2	to Paisley	39	..
3	to Glasgow ..	36	..

Wednesday, 23d July.

10 o'clock coach	to Paisley	35	minutes.
11	to Glasgow ..	34	..
12	to Paisley	37	..
1	to Glasgow ..	36	..
2	to Paisley	50	..
3	to Glasgow ..	37	..

We have only further to remark, that the carriage which left Glasgow yesterday, at twelve o'clock, did the distance, from the Half-way House to Paisley, fully 3½ miles, in ten minutes, being at the rate of 20 miles an hour!—*Glasgow Courier, July 24.*

The author of "The Touchstone, or Paradoxes brought to the test of a rigorous and fair examination, printed for Noon, 1732," appears to have been the original projector of sailing through the air in a boat suspended to a ball.—*Notes on Vathek.*

The origin of spectacles can be traced back with certainty no higher than the thirteenth century, yet the observation of Seneca, that the letters appeared of an increased magnitude when viewed through the medium of a convex glass, might have been noted also by others, and a sort of spectacles contrived in consequence of it.—*Ibid.*

Purification of Smoke.—It appears from the Berlin journals, that a Saxon architect, of the name of Bernhardt, has discovered a chemical process, by which the smoke of chimneys may be instantaneously and completely purified; and that it has been applied with the greatest success at the royal palace, and other public establishments of the Prussian capital. The most remarkable (incredible?) part of the affair is, that M. Bernhardt has been able to keep his method a secret, notwithstanding so many instances of its application, and the very obvious nature of the effects produced.

If *Blank Windows* are ever allowable in original compositions, it can only be where they form part of a system of windows. To introduce them where they form no part of such a system—that is, where there are no real windows at all in the elevation, as in the exterior elevation of the Bank of England, and in the front of the National Gallery, at Charing Cross—is contrary to every sound principle of architectural composition.—*Architectural Magazine for August.*

Dying Maple or Satin Wood with Cochineal.—I observe, in a London newspaper, a notice of the invention of a mode of embellishing maple or satin wood by dying it with cochineal. This is an old Swedish practice. In that country they use knotty pieces and roots of the birch, which they appear to plane with a plane that is not very sharp, so as to throw up the fibre more in some places than in *others; they then dip these thin boards into dyes of various kinds; and as the raised fibre imbibes colours faster than the smooth* cut parts, a delicate variety of tint is easily produced. The boards when dry are smoothed and varnished, and make very beautiful furniture.—J. R.—*Ibid.*

Slate has lately been used as flooring for shops in London, and it has also been laid down in the Strand as foot pavement, in order to prove, by experiment, its durability relatively to that of Yorkshire flagstone. Its strength is such, that it might be used in all warehouses instead of boards for the floors; and thus, by means of cast-iron joists, such buildings might be most effectually rendered fire-proof. In common dwelling-houses, fire-proof partitions, and fire-proof chests and closets, might be formed of the same material, joined by iron or copper.—*Ibid.*

Formerly fleets lay for weeks at the Nore waiting for a wind to carry them up the Thames or Medway, causing great expense of delay; whereas now, a few steamers, under almost all circumstances, will insure their arrival in one tide. By this means Chatham and Woolwich, though in the heart of the country, are become two of the most valuable military posts in the kingdom; and Sheerness, built on piles in the sea, on which so much money has been expended, and which presents one of the finest monuments of British enterprise and ingenuity, by the same means has lost most of its value, &c. The works of Sheerness are very magnificent; the basin is 520 feet long by 320 wide, and is capable of accommodating 16 line-of battle ships.—*United Service Journal for August.*

Steam Carriages.—A small steam drag has for the last week been running upon the Stratford road, which, we understand, has been built by Mr. Walter Hancock, under an order from Austria. The weight does not exceed two and a half tons (including water and fuel for nine miles), yet it has made four or five journeys a day, with a steadiness and regularity exceeding all precedent. The average speed of this carriage is from 11 to 12 miles an hour; and although the road was *new gravelled* for miles together, it passed over this obstacle with astonishing facility, at nine miles, and was propelled up hill at the same rate. The vehicle was well loaded with foreigners of the first respectability, and steered with much skill by the proprietor, Mr. Voigtlander, engineer, of Vienna.—*Albion.*

We mentioned, last week, that it had been resolved to make trial, on the Birmingham railway, of slabs of slate fixed in a bed of concrete, as a substitute for the usual stone sleepers. We have since been informed that, in an experiment previously made on the premises of Messrs. Cottam and Hallem, in the presence of the engineer and several of the directors of the Company, it was found, by the hydraulic press, that a cubic inch of slate will sustain a pressure of three tons and a half, and that consequently slate of an inch and a half thick is more than equal to any pressure which it can be required to support on a railway. The saving in expense, if slate is ultimately adopted, will be at least one half.

The meeting for the present year of the British Association for the Advancement of Science, is to be held at Edinburgh, during the week commencing Monday, Sept. 8.

Communications received from Columella—J. J. H.—Mr. Bowser—Mr. Holland—Mr. Buckland—N. A. N.

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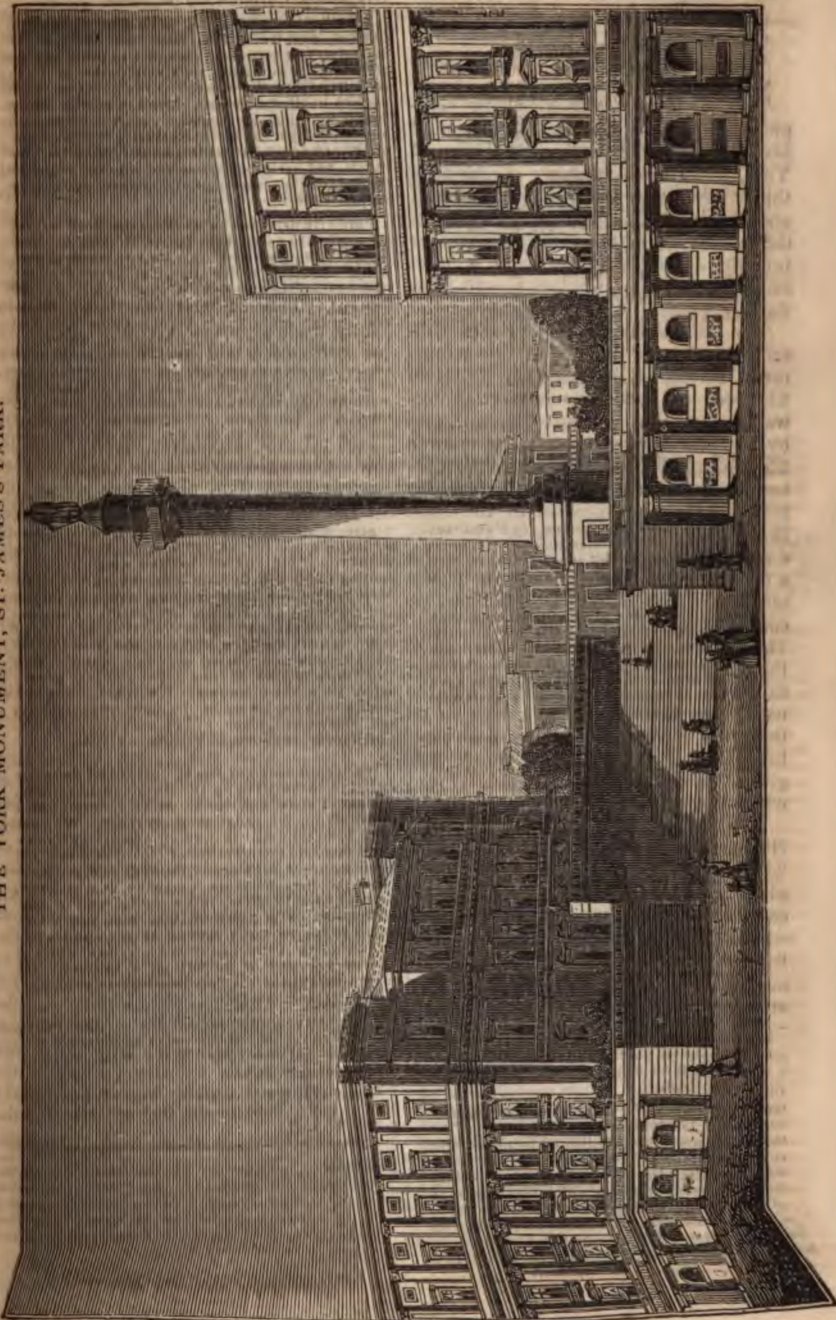
Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 574. SATURDAY, AUGUST 9, 1834. Price 3*d*.



THE YORK MONUMENT, ST. JAMES'S PARK.

A DESCRIPTIVE ACCOUNT OF THE DUKE OF YORK'S MONUMENT, ACCOMPANIED BY PLANS, ELEVATIONS AND SECTIONS. Copied from the Designs of BENJAMIN WYATT, Esq. Architect. By Mr. ROBERTSON.*

This monument which is now complete, and crowned with the statue of his late Royal Highness the Duke of York, forms a very striking ornament to the neighbourhood in which it stands; and, as it occupies the exact centre of the great opening from Carlton-gardens into St. James's-park, it is in a most imposing situation, whether viewed from the latter place, or from Regent-street.

The sum collected by private subscription for the erection of this monument amounted, in the year 1829, to 21,000*l.*, and this sum was shortly afterwards (by the interest thereon, and by further contributions) augmented to 25,000*l.* In the same year the committee of noblemen and gentlemen for managing the application of the fund thus raised, invited a few of the most eminent architects to submit designs for a monument to commemorate the public services of the late Duke of York, as commander-in-chief of the British army. The competitors accordingly delivered in their designs, accompanied by estimates, in the month of August, 1829; but the committee did not come to a decision on their merits until the month of December, 1830, when the preference was given to the designs of Mr. Wyatt, which designs were then finally adopted.

The monument was erected by Mr. Nowell, of Grosvenor-wharf, Pimlico, who was under an engagement to complete it in every respect, with the exception of the statue, within a period which should not exceed two years, and for the sum of 15,760*l.* 9*s.* 6*d.* He completed his task in one year and eight months, and has certainly done it in a most substantial and workman-like manner.

The architect and builder were put in possession of the ground on the 25th of April, 1831, the excavations commenced on the 27th of the same month, and they were finished in twenty-eight days. These excavations were dug to about 22 ft. below the general surface, in order to obtain a solid stratum of natural earth; and an artificial foundation was then formed of concrete, of sufficient magnitude to fill up the excavations, and of sufficient solidity to sustain the superincumbent weight of the monument. This artificial foundation was in form the frustum of a pyramid, covering a space of 2,809 superficial feet at its base, and having a surface of 900 superficial feet at the top.* A course of Yorkshire stone slabs, 7 in. in thickness, was laid all over the surface of the concrete, when brought up to half its height; that is, at 11 ft. 6 in. above the level of its base line, in order to equalise the pressure from above, and a second course of stone was, for the same purpose, laid upon the top of the body of the concrete. This foundation, which was laid on the 25th of May, 1831, was finished on the 25th of June, and in three weeks afterwards the masonry was commenced; for by this time the concrete had become as compact and solid, as if it had been a natural rock of granite.

The masonry was begun by a course of rough granite being laid on the top of the Yorkshire stone slabs; and the pedestal, which is 16 feet 8 in. in height, and consists of ten courses, is built of the famous Aberdeenshire grey granite. The capital and base of the column are also of grey granite, but of a darker tone of colour that that of the pedestal: the shaft of the column, and the aeroter or upper pedestal, are built of Peterhead red granite. The shaft, from the top of the base to the bottom of the capital, consists of twenty-six courses: on the west side there are seven apertures, and on the east six, for the admission of light to the staircase. The column, which is of the Tuscan order, is 94 ft. 4 in. in height,

* Having lately given a description of the means taken by the French to transport the obelisk of Luxor to Paris, we should be wanting in justice to the mechanical talent of our own country, were we not to record also the analogous, and nearly contemporary operations connected with the erection of the York column, in Carlton-gardens. We copy the very ample and satisfactory details on the subject, which we now lay before our readers, from the *Architectural Magazine*, by permission of its enlightened and public-spirited editor—a journal which every person who is professionally *interested in architecture*, or has a taste for *architectural beauty, ought to patronise.*—ED. M. M.

* The concrete was brought to its proper line of inclination by means of boards fixed at each of the four angles, and lines occasionally strained from one angle to another; and the concrete when brought to its proper position firmly retained that position.

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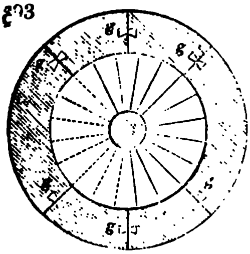

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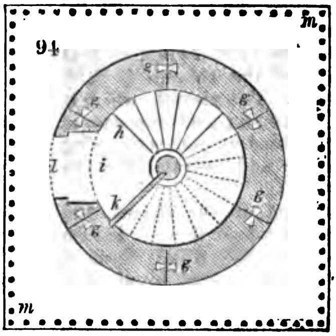

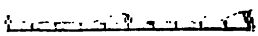

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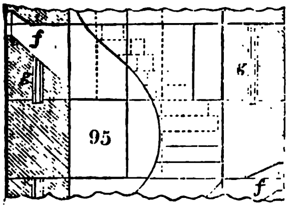

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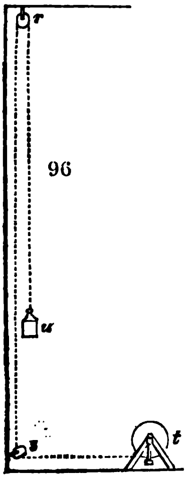

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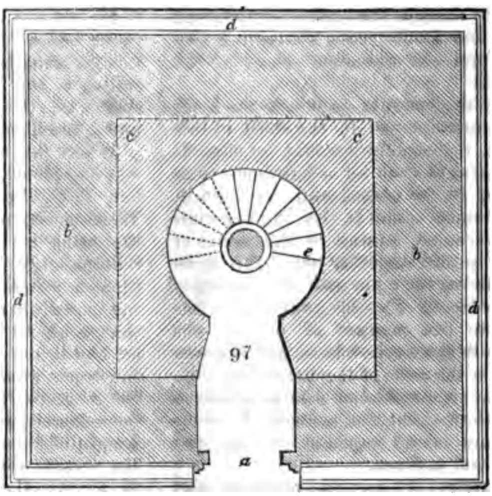

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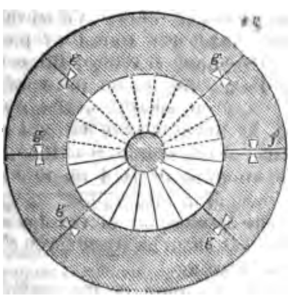

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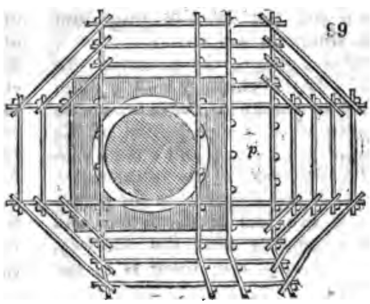


including the base and capital: the inferior diameter is 10 ft. $1\frac{3}{8}$ in., and the lower diameter is 11 ft. $7\frac{1}{2}$ in.; so that the proportion of the column is fully eight diameters. The aeroter, which is 12 ft. 6 in. in height, and consists of seven courses, forms at once a covering for the staircase and pedestal for the statue to stand on.

The upper bed of the abacus (on the outer edge of which there is fixed a plain substantial iron railing) forms a gallery, to which we ascend by winding stairs through the interior of the column, and from which there is a delightful and extensive view of the surrounding scenery; the outlet to this gallery is by a door in the east side of the aeroter. The stairs consist of 168 steps, 2 ft. 4 in. wide; each course in the shaft is exactly the height of five steps: and these five steps in one course are placed alternately at right angles to those of the preceding course; so that four stones, each containing five steps, form one complete round of the staircase.

From the manner in which the bond stones are employed in the shaft of this column, the structure would be of sufficient strength even for a lighthouse surrounded by the ocean, and this peculiarity of construction is, that the five steps of each course, as well as the newel or central pillar, together with the stone which forms the outer wall, *are cut out of the solid block!* This circumstance (in addition to the manner of joining the courses by dove-tailed keys, and the way in which the ends of the steps that form the newel are spiked or plugged to each other) shows that the courses of the column are bound together in the most substantial manner.

Fig. 92 is a geometrical representation of the monument. The entrance, which is at the top of the stairs leading from the park, fronts the south.

Fig. 97 is a plan of the pedestal. In this plan *a* is the entrance; *b* the outer casing of grey granite; *c*, the inner casing of red granite; *d*, the projection of the mouldings of the base; and *e* the situation of the first riser of the spiral stairs. The newel of the staircase in the pedestal part is two feet in diameter; and there is a landing near the doorway, *which is the only one* there is in the *whole height*.

Fig. 98 is a plan of the lower diameter of the shaft, in which are seen the apertures (*f*) for admitting light to the staircase; and the dove-tailed keys (*g*) at each joint, The outside wall in this plan is 2 ft. 7 in. in thickness, and the newel is 1 ft. 6 in. in diameter, from the top of the pedestal to the level of the gallery.

Fig 95 is a vertical section of the shaft, showing the openings for admitting light (*f*); and a section of the keys (*g*) which pass down through the whole course, and are inserted 2 in. in the middle of the stones of the courses immediately below. They are of Gloucestershire stone, and grafted in with Parker's best cement.

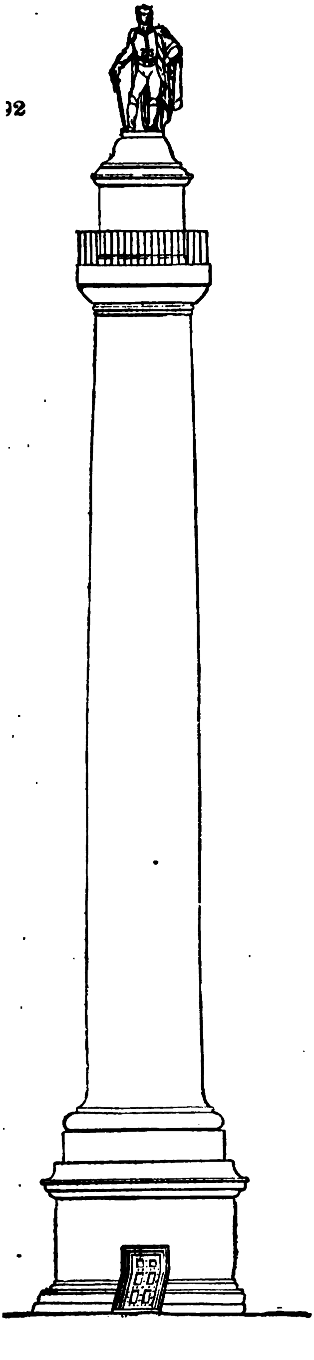
Fig. 93 is a plan of a smaller diameter of the shaft. In this plan the thickness of the outer wall is, from the diminution of the column, only 1 ft. $10\frac{1}{2}$ in. The keys and joints are shown at *g*.

Fig. 94 is a plan of the aeroter, and upper bed of the abacus. In this plan, *h* is the situation of the last riser of the stairs; *i*, the landing; *k*, a large stone slab 4 in. thick, to finish the landing; and *l*, the door leading to the gallery *m*,

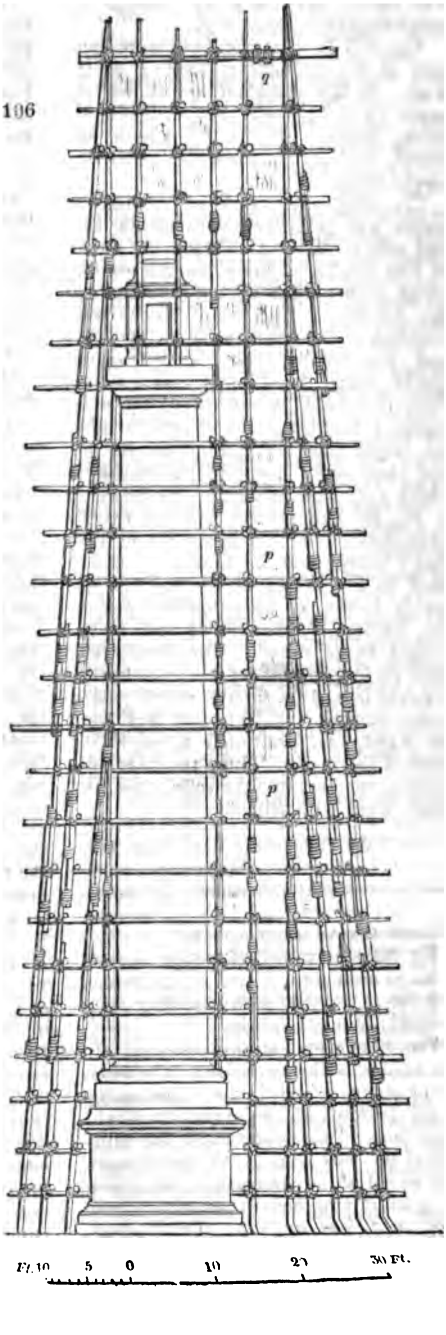
When the masonry of the monument was completed, in the month of December, 1833, the statue, which is by Mr. Westmacott, was not finished; and as the artist at this time required several months longer for its completion, it was thought advisable to remove the scaffolding, notwithstanding the great expense that would be incurred by its re-erection; as, had it remained through the winter, the ropes would have become rotten by the frost, and the scaffolding would have been thereby rendered unsafe to bear the weight of hoisting up the figure. When the statue was completed, Mr. Nowell in a very short time erected a simple yet ingenious and scientific scaffolding, of mere poles and ropes; and on the 8th of April, 1834, the statue of his late Royal Highness (having slings and chains round the arms, to which the tackle was attached) gradually ascended, at about double the rate of the movement at the extremity of the minute hand of an ordinary sized church clock, in presence of a vast number of spectators. The hoisting up of the figure was completed at about half-past seven o'clock the same evening.

Fig. 99 is a plan of the scaffolding.

92



106



The statue was drawn up through the parallelogramic space at *p*.

Fig. 106 is a geometrical representation of the scaffolding, looking to the west. In this elevation are shown the space (*p p*) between the perpendicular poles, through which the statue was raised, and (*q*) the beams to which the blocks were attached.

The responsible task of raising the statue was performed with much ease and safety. It was elevated by means of four machines placed on the ground, which were worked upon the principle of the windlass. Four large blocks were attached to the beam at *q*, in fig. 106; and four smaller ones, called match blocks, were fixed near the ground. From the crabs or machines, the ropes passed through the match blocks up to the larger blocks or pulleys at the top, and then came down to the statue, to which they were attached. By referring to fig. 96, the process will be readily understood. In this figure let us suppose *r* to represent the four large blocks fixed to the beams at the top; *s*, the match blocks, or four smaller ones, at the bottom; *t*, the crabs; and *v*, the weight to be raised. The figure was fixed on its pedestal by means of bars of wrought iron, 4 in. square, which passed down through the body and legs from the waist, and protruded through the heels of the boots. These two bars were inserted two feet into the solid stone, and firmly fixed with solder.

Fig. 107§ is a view from St. James's-park, showing the relative situation of the monument with the buildings that surround it. In the fore-ground are seen the elegant structures of Carlton-terrace, and, in the distance, the Athenæum and the Travellers' club-houses.

The whole height of the monument is 123 ft. 6 in., and it is therefore about the same dimensions as the column of which it is a copy, namely, the celebrated Trajan's column at Rome. The height of the statue is 13 ft. 3 in., which makes the whole height from the ground line to the top of the figure 137 ft. 3 in., but when viewed from the bottom of the steps, at the level of St. James's-park, the altitude is 155 ft. 3 in.

It may not be uninteresting to compare the dimensions of this monument with that of Fish-street-hill, London, erected by Parliament from the designs of Sir Christopher Wren, to commemorate the burning of the City in the year 1666, and the monument erected to the memory of Lord Melville, in St. Andrew's-square, Edinburgh. This latter monument is of much the same form as that of the Duke of York, but the column is fluted, and the pedestal ornamented with festoons. It is built of Killala stone, from the designs of Wm. Burn, Esq., architect, Edinburgh. The building was executed by Mr. Alexander Armstrong, of that place, and completed in August, 1832.

	City Monument.	Duke of York's.	Lord Melville's.
	ft. in.	ft. in.	ft. in.
Height from the ground to the top	.. 202 0 ..	.. 137 9* ..	.. 152 7
Diameter of the column	.. 15 0 ..	.. 11 7½..	.. 12 2
Circumference of the pedestal	.. 128 0 ..	.. 75 0 ..	.. 72 0
Height of the pedestal	.. 40 0 ..	.. 16 8 ..	.. 18 4
Height of the gallery from the ground..	.. 170 0 ..	.. 111 0 ..	.. 120 10
Height above the gallery	.. 32 0† ..	.. 23 6‡ ..	.. 31 9‡
Number of steps in the stair	.. 365 ..	.. 168 ..	.. 196
Time taken in building................	.. 6 years.	.. 1 yr. 8 mo.	

Although the Duke of York's monument is much inferior in magnitude to that of Fish-street-hill, and to Melville's monument (the statue on the latter is 18 ft. high), it must nevertheless be looked upon as an undertaking of no ordinary merit; for, whether we consider the peculiarity of the artificial foundation, the successful mode of forming the casing or wall of the staircase, the steps and the newel all in one piece. The difficulty of procuring blocks large enough for this purpose from Scotland, and that of finding vessels with hatchways sufficiently large to admit these blocks into their holds—the hardness of

* *Including statue.* † Including blazoned urn. ‡ Including statue. § See our front page.

granite to work with the chisel—and the many other contingent circumstances —we must look upon this monument as a great and magnificent work. It may be worthy of a passing remark that the stairs of this monument, as well as that of Melville's monument, wind round to the left, while the stairs of the City monument wind round to the right, and the stairs to the "whispering gallery" of St. Paul's wind round a well-hole on the left. There is an important advantage in having spiral stairs winding to the left, because in that case the hand-rail, which ought always to be to the right in ascending, is attached to the outer wall; therefore a person holding it in going up, walks upon the broadest part of the step. The contemporary press seems to consider, with reference to the statue, that the figure is too clumsy, and that Mr. Westmacott has fallen into an error by associating the Order of the Garter with boots and cuirass belonging exclusively to cavalry uniform. I shall leave this part of the subject to be decided by competent judges, and content myself by remarking, in conclusion, that I think the gentlemen of the committee have fully discharged their duty, and that they have been singularly fortunate in selecting an architect so eminently qualified to furnish the designs for this noble structure, and a builder who thoroughly understood those designs, and worked up to them in a tradesman-like manner.

The monument was opened to the public on Wednesday the 23d of April, at a shilling per head; and I understand that the funds which will be raised are to be applied to the relief of the widows and orphans of soldiers.

J. ROBERTSON.

Bayswater, April 26, 1834.

POINTS OF ARCHITECTURAL SUBLIMITY IN LONDON.

"There were thunderings, and lightnings, and voices."—*Book of Revelations.*

Magdalen College, Cambridge, August 1, 1834.

My dear Sir,—I was lately for some time in London, giving evidence before a Committee of the House of Commons on the proposed improvements of the navigation of the *Shannon and the* Fergus; *the latter the river of* my native Clare.

While I was in that mighty metropolis, I revived with my name, a proposal originally published anonymously in a letter to the editor of the *Times*, for the erection of a national monument to Newton, worthy of England and of his memory. It was from this college I wrote my original letter to the editor, who is himself a highly distinguished graduate of our University.

Being now here again, after long absence, for a day or two before my return to Ireland, I do not think I can do any thing more in unison with the feelings with which, retired from political turmoil, I once more repose within my college walls, than writing a few pages to call your attention to two magnificent combinations to be found in London. Of each of these St. Paul's Cathedral is the basis—each is *unique* in its way,—there is nothing like either of them to be found any where else in the world: one has been always known, but the other does not appear to have been observed by any one else but myself—at least the public attention does not appear to have been called to it by any one before.

Suppose yourself to stand at the eastern extremity of the quay at Bankside, near the new London-bridge, and looking up the Thames, you will observe the great circular tower and dome of St. Paul's Cathedral appearing *directly over the centre arch* of the Southwark cast-iron bridge.

Thus you have the very greatest arch in the world, and the second dome in the world, *at one view, in exquisitely picturesque combination—and in exquisite proportion to each other, too*; each is enormous, and so, therefore, they are both together in unison in their vastness. It is a truly sublime architectural combination.

Is there any thing equal to it at Rome? No; on the very contrary, it was by contrasting it with a view in Rome, that I was first astounded by its transcendent grandeur.

I had often stood upon the side of the Tiber, to view the dome of the Vatican over the bridge of St. Angelo. But in this view there was no harmony; because the bridge bore no proportion to the stupendous Vatican. There was no harmony here; but in London the harmony is exquisite, between the mighty bridge over the waters of the river, and the mighty

dome, that "upheaves its vastness" "buried in air." The two come together in magical combination:—in consequence, first, of their relative positions; and, secondly, of the gorgeous perfection of their proportion to each other in their enormous dimensions.

Lord Byron says in "Childe Harold," and there never was any thing more true:—

"There is a pleasure in the pathless woods;
There is a rapture on the lonely shore;
There is society where none intrudes
By the deep sea, and MUSIC IN ITS ROAR."

About St. Paul's there is a two-fold sublimity—as an object of vision—and it is doubly sublime as a musical instrument. I do not call it so in quaintness, for with Lord Byron's authority, which I have just quoted, I think the form of expression a good one.

In the *Tempest* of Shakspeare, too, the thunder is called "that deep and dreadful organ-pipe;" another precedent in my favour, and peculiarly apposite to my purpose:

"Methought, the billows spoke and told me of it,
The winds did sing it to me, and the thunder,
THAT DEEP AND DREADFUL ORGAN-PIPE, pronounced
The name of ——."

Who that has a perception of the sublime in the works of art or of nature, has been ever in the great circular gallery in St. Paul's — "the whispering gallery"—and while he gazed above to the summit of the dome, and across the enormous diameter of the yawning abyss beneath the gallery, and viewed the sepulchres and monuments of "the mighty dead" in the gulf beneath him, and after listening to the solemn preludizing of the mystic sounds that swept around him—like the voices of spirits of another world—then looked down the chasm, and, while doing so, heard the awful sounds produced by such simple means put in action at the opposite side of the gallery—the repercussive roar, like the reverberation of a thunder's peal—who that has seen and heard all this, unless he is prepared to deny that there is music in the roar of ocean, can deny that the church of St. Paul's is a deep and solemn instrument of music, the most sublime!

Such sounds were never heard within *any other building* in the world.

The view from the gallery of the Vatican is superior to the view from the gallery of the metropolitan church of London; but in this case the sight alone is astounded, but in St. Paul's the soul is taken by an irresistible spell that overwhelms it, and makes it captive by the sentiment of sublimity through two senses together—the hearing and the vision.

Go alone, in the gloom of a winter's evening, into the gallery of St. Peter's, and the effect is no more to be forgotten than the view down the crater of Vesuvius, as I have seen it from the verge, when looking down from amidst sulphureous smoke, into the lava flood that was boiling in its abyss-breast of flame: the deep silence of St. Peter's at such a moment as I have described, is sublime to the very last extremity; but St. Paul's, like Vesuvius, can give awful sounds as well as awful scenery.

I have for some time intended to embody these conceptions in an article for publication; and something very lately suggested itself to me, which induces me to add it, as it perhaps may not be entirely uninteresting to artists, particularly to those who devote themselves to architecture.

It occurred to me that I could, in the following manner, get something like the *general effect* of such a building as that which I have proposed for a national monument to Newton in my letters to the Editor of the *Times*.

I cut out from one of my pictures the view of the proposed building, but preserved the outline with the utmost accuracy. Then going in the gloom of the evening, in what in Scotland would be called "the gloaming," that the angular parts might not obtrude themselves too strongly, and so to a certain extent cause a failure of my purpose, if too distinctly defined, I held up the paper before me from which I had cut out the picture, in such a manner, that, standing in Cheapside, the base of my design appeared to coincide with the base of St. Paul's (a sort of crude coincidence of course, in consequence of the angle at the transept), and that the highest point of my designed building should, at the same time, appear to coincide with a point of the great tower of the cathedral, about 200 feet high—the height of the building which I propose to have erected.

Thus you will perceive that I made use of the mighty pile already in existence, in a manner somewhat analogous to that in which a sculptor uses a block of marble in order to hew out his form; for, by the process I have described, I not only perfectly, as it were, hewed out from the church the *form* I wanted to view, *but also got before me the dimensions* of my proposed building, delineated perfectly to my vision, when I looked through the paper from which (as I have said before, accurately preserving the outline) I had cut out my design.

Perhaps these few observations may not be entirely uninteresting to those who take an interest in architectural combinations, and the general harmonies of nature.

In a description I wrote of Cadiz, that magically beautiful city, where, after the fall of Paphos, Lord Byron says Venus deigned to fix her shrine, there is the following passage:—"Some years ago, when I was in Rome, I frequently passed whole hours together in roaming round the Colliseum, and through its arena and arches and galleries, by which I formed to myself a series, to infinity, of beautiful combinations. When I spoke of this amusement to my friend Gabrielli, who is a musician as well as painter, I, laughingly, called it playing a melody on the Colliseum,—and a number of such melodies might be well played in Cadiz."

Yes, there are melodies of this kind in Cadiz of magic fascination; and I have quoted the passage about *melody* as bearing something of analogy to part of what I have been writing now, viz., *harmonies* of nature. "The Lady," in Milton's *Comus* invokes Echo—

> "Sweet Echo! sweetest nymph that dwell'st unseen
> Within thy airy cell," &c.

And describes her as giving "a resounding grace to *all Heaven's harmonies*."

Now, if echo ever gave, in this world, a harmony worthy of Heaven, it was when her voice was first heard in the appalling and thunder peal-like repercussion in the Church of St. Paul's—when her voice, from within her airy cell, was as if the "seven thunders," described in the book of *Revelations*, had "*uttered their voices.*

No—not from the time when God himself sanctified with his presence the Ark of the Covenant within the Tabernacle, sitting on the Mercy-seat between the Cherubim; in Horeb, or Horonaim, or by the Brook of Cedron, or Siloa, or in Zoar, or on Mount Hermon, or on Sion-Hill; was there ever a place consecrated to his worship, so awfully solemn and sublime, as that thunder-pealing temple, the vast Cathedral of St. Paul!

Could any thing increase the sublimity I have vainly made an attempt to describe? Yes—if those sounds were to be produced in the dreary depth of winter midnight; while the only illunation for a person in the gallery should be from the flashing of lurid lightnings in the firmament, from time to time showing the interior for a moment, and then again as suddenly leaving it in darkness.

I have the honour to be,

My dear Sir,

Ever most sincerely yours,

THOMAS STEELE.

A Member of the Senate of this University.

[We heartily congratulate our worthy friend, Mr. Steele, on his return to academic bowers, from the stormy paths of Irish agitation. It is not for us to estimate the value of his services to his country, as an agitator of political grievances; but we may be permitted to doubt whether all the good he ever did in that capacity, will stand a comparison with the great and enduring benefits he has conferred on Ireland, by his scientific and persevering efforts for the improvement of the Shannon and Fergus navigation. In a book which he wrote a few years ago on the subject, he pointed out most forcibly to public attention the immense capabilities of this line of inland communication, and at the same time the very considerable drawbacks to which it was subject, from the want of lights in suitable situations, and the existence of some dangerous shoals and rocks, which admitted of being easily removed. Since then, Mr. Steele has had the satisfaction of seeing most of his suggestions either carried into effect, or in the progress of being so. A lighthouse has been erected on the Tarbert rock in the lower Shannon, and Tarbert has now become an asylum harbour for all ships entering the Shannon; and a Select Committee of the House of Commons is now engaged in considering the expediency of promoting, by legislative authority and assistance, the execution of other equally important improvements. Mr. Steele was examined at great length by this Committee before he left town. As regards the matter of his present communication, we would just add, that should he succeed in his other long-cherished and favourite project, of erecting a national monument to the illustrious Newton, over the house in which he resided, near Leicester-square, he will add one point of architectural sublimity to our metropolis, quite equal to any of those which he has here so eloquently described.—ED. M. M.

LANG'S HISTORY OF NEW SOUTH WALES.

Notwithstanding the promise of Dr. Lang's very comprehensive title-page,* we are afraid that a standard history of Australia is yet to seek. The historical portion of the doctor's work is, in fact, principally a running commentary of a very gossipping description, on *some* of the sayings and doings of the past and present governors; while the "Statistical Account" is wanting altogether. We presume that the mention of such a thing in the title must have been a simple error of the press; but it is a pity that it was not corrected before the work was issued to a censorious public. This said title is, in truth, a misnomer altogether: since the staple of the work consists, instead of a history of the colony, of a history of the Rev. Dr. Lang's various attempts, with various success, to obtain from the Government, both abroad and at home, a *proper* sum per annum for behoof of *himself*, and the rest of the Presbyterian clergy of New South Wales. This is evidently the object nearest to the doctor's heart, and accordingly he by no means stints himself to space in dilating upon it, in season or out of season, and whether his readers may like it or no—to such a degree, indeed, that the veritable searcher for information on the history and statistics of our Australian colonies, may well be tempted to consider him as an "obtainer of his attention under false pretences," and to grumble not a little at his allowing *the cloth* to peep out so often and so largely.

The second volume, especially, is almost entirely devoted to the author's crotchet, and the record of his squabblings with "all sorts and conditions of people," both in his "adopted country" and his "father-land;" and, when he *has* got away to other subjects, he cannot refrain, every now and then, from having a jaunt on the old hobby, whenever an opportunity occurs; nay, even when it does not, for the doctor is by no means particular on that score.

The book, nevertheless, commences *secundem artem*, with a chapter on the "Progressive Discovery of the Coast of New Holland;" in which the exploded error is fallen into of transforming the Dutch vessel "Zeehaen" into a "Captain Zeachen: a compositor's blunder (originally), which bids fair to be immortal. It is not, however, on the accuracy of his information that our author relies, in his commencing chapters, but rather on the raciness that must necessarily be given to them by the fact of their having been written on board ship, in "a high southern latitude:" a fact which is continually being thrust on the notice of the reader, as if it were considered a perfectly valid excuse for "all faults and errors of description." So confident is the doctor of its proving such, that he has no hesitation in telling his readers, that "the *only authorities* to which he was able to refer in the earlier part of the work, were Captain Phillip's and Captain Hunter's Voyages to New South Wales, with the printed report of a trial that took place in the colony in the year 1808. Rich and rare materials these for a standard "Historical Account"! But then the chapters that have burgeoned out from this slender stock, were penned in the midst of a floating mass of the largest icebergs the doctor ever saw! Let us be thankful, then, for what we have got: even as no one grudges a penny for a piece of frost-fair typography, not intrinsically worth the fourth part of a farthing.

It is needless, after this, to observe, that the second and third chapters, which relate to the first establishment of the colony, and its state under the three first governors, are full of errors and (to speak Hibernically) of omissions. Dr. Lang appears not only to have been unable to refer to Collins's work on the subject (which contains a considerable fund of valuable information on the early circumstances of the settlement), but never to have seen the book. The system of book-making is now so well understood, that few "authors" take the trouble of pouring out of many small bottles into one large, but very coolly make their mixture at once out of the two or three biggish jars which happen to be near at had: to speak less metaphorically, few of the fraternity now-a-days blush to own that they have drawn

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* An Historical and Statistical Account of New South Wales, both as a Penal Settlement and as a British Colony. By John Dunmore Lang, D.D., Senior Minister of the Scots' Church, and Principal of the Australian College, Sydney, New South Wales. *"We have seen the land, and, behold, it is very good."* London: 1834. Cochrane and *M'Crone.* 2 vols. 8vo. pp. 401, 443.

their matter only from a few of the most accessible works on the subject, and most of them have not even the sailor-like excuse of Dr. Lang to offer in extenuation.

The succeeding chapters are devoted to the governorships of Bligh, Macquarie, Brisbane (in whose administration Dr. Lang first arrived in Australia), Darling, and Bourke (the present governor):—the most stirring incident in which is the rebellion in which Capt. Bligh, the well-known commander of the Bounty, was deposed from his authority by the officers of the New South Wales corps, and Mr. Macarthur, who, strange to relate, is now one of the greatest landed proprietors in the colony! From the chapter on Governor Darling we shall extract, as a favourable specimen of our author's facetious vein—the vein in which he most frequently indulges, and is most at home, although, withal, rather too prolix even in that—his account of the raging of what he justly calls "the sheep and cattle mania," during the era of bubbles of all sorts, both abroad and at home:—

"No sooner had the existence of the Agricultural Company been duly announced, and its operations commenced in right earnest, than the *sheep and cattle mania*— a species of madness undescribed by Cullen, and formerly unknown even in the colony—instantly seized on all ranks and classes of its inhabitants. We are told by Thucydides, that, during the prevalence of the plague in Athens, the wretched victims of that hopeless disease were impelled by their intolerable thirst to the fountains and streams of water, around which they died in great numbers. The colonial mania I have just mentioned evinced itself in like manner, in impelling whomsoever it seized to the cattle-market; and as my own residence in Sydney, for about three years after my return to the colony in the month of January, 1826, was in the immediate vicinity of that busy scene, I had frequent opportunities of observing the congregated patients, and abundant reason to wonder how the matter would end. For barristers and attorneys, military officers of every rank, and civilians of every department; clergymen and medical men; merchants, settlers, and dealers in general, were there seen promiscuously mingled together every Thursday, and outbidding each other in the most determined manner, either in their own persons, *or by proxies of certified agricultural character, for the purchase* of every scabbed sheep, or scare-crow horse, or buffalo cow, that was offered for sale in the colony. In short, it was universally allowed that the calculations of the projectors of the Agricultural Company could not possibly be inaccurate. Their statements and reasonings were supported by arithmetical—which every person allowed were the best of all — arguments; and it was made as clear as the daylight to the comprehension of stupidity itself, that the owner of a certain number of sheep or cattle in New South Wales must, in a certain number of years, infallibly make an independent fortune. It was consequently determined on all hands, and by all sorts of persons, that the Agricultural Company should not be the only reaper of this golden harvest. * * * * * The reader may perhaps imagine that I must have been a dealer in sheep and cattle myself, to have acquired all this unclerical knowledge; I have never, however, had the honour to be the owner of a single head of either in the colony. But it was impossible to live in New South Wales, at the time I allude to, without acquiring much more knowledge of this kind than was at all desirable. 'Their talk,' as Dr. Johnson remarks of some of his friends in the country, 'was all of runts' or heifers. If an advice was given in company, it was by all means to *to get into a good stock*, for *there was nothing like it*. If a difference of opinion arose, it was either whether Saxon or Merino, fine or coarse woolled, sheep were the most profitable, or whether it was advantageous to attend exclusively to the wool, or to combine, with all due attention to that matter of universally acknowledged interest, a proper regard to the carcase. Again, and again, I have had specimens of wool submitted to my own inspection by Saxon or Merino enthusiasts, who were in the habit of carrying them about with them in their pockets; and if the excuse of imperfect vision and entire unacquaintance with the subject was insufficient to relieve me from the very invidious task of deciding in a matter so much above my capacity, I was generally unfortunate in selecting a different specimen from the one which had been previously determined to be the finest. In short, if there ever was a place in the world where a whole community seemed for a considerable period to have only one idea, it was New South Wales; and this exclusive and universally predominant idea was, that of rapidly acquiring an independent fortune by the rearing of sheep and cattle."—Vol. i. p. 195.

This folly, of course, in due time cured itself, but not without bringing ruin on

hundreds of victims. New South Wales seems destined to become a favourite theatre for speculation. At the present moment even, so long after the joint-stock furor is supposed to have evaporated, a new "concern" has just commenced operations, having for its object the colonisation of "South Australia," on the novel principle of "keeping up the due proportion between land and labour," by constantly pouring a fresh influx of labourers into the colony, and (by means of arbitrary regulations as to the purchase of land) preventing the labouring classes as much as possible from bettering their condition by becoming land-owners! And this scheme is specially patronised by our self-styled *liberal* members of Parliament, and, above all, by the very economistis who hold that the distress of England is owing to its superabundant labouring population! Sagacious scheme! to ensure the prosperity of the new settlement by artificially producing the very same state of things which we are told, with a woful countenance, *must* be submitted to, from absolute necessity, in England! To add to the chances of success, these ardent declaimers against the "dead weight" propose to relieve themselves of the disagreeable task of advancing any cash of their own, to carry their project into effect, by raising forthwith a considerable loan (on the security of lands at present in the sole possession of the kangaroos), and starting the nascent colony "all fair" with a nice little national debt of two hundred thousand pounds on its back! The *sheep and cattle* mania was sense itself to this. It requires little foresight to perceive that, should the monstrous scheme be persisted in, on the principles now laid down for its conduct, it will end in the labourers making their escape to Van Diemen's Land, or any other land where they will be allowed fair play,—or, should that be forcibly prevented, by their "taking affairs into their own hands," and, before the Commissioners, who are to manage the affairs in London, can hear of it, actually effecting a complete revolution in the important state of South Australia. It is ten to one, however, that all those grand "principles," on which *alone* we are *assured a colony* can possibly flourish, *will, one by one,* be thrown overboard very soon after the attempt to put them in practice has been made. We shall see.

To return to Australia as it is: Dr. Lang gives a somewhat interesting account of the whale fishery of the colony:

"The most prominent, if not the most important, branch of the trade of New South Wales at the present moment, is the sperm and black whale fishery, in which no fewer than from forty-five to fifty square-rigged vessels, of various tonnage, are now employed out of the port of Sydney. These vessels are all furnished with provisions for their voyage of the produce of the colony; their whaling-gear is chiefly manufactured of New Zealand flax by the rope-spinners of Sydney; and the large sums of money distributed among their officers and crews, on their return to port after a successful voyage, are all expended in the colony. The black or right whale is of the species that is caught exclusively in the Greenland seas. The sperm-whale fishery, however, is by far the most important of the two; and the whaling-ground, chiefly traversed by vessels from Sydney, extends all over the Western Pacific, from the heads of Port Jackson to the sea of Japan. The length of the voyage, in these hunting expeditions, depends entirely on the success of the vessel; and the latter depends, in great measure, on the experience and ability of the officers and crews. The last arrival from the sperm-whale fishery, before I left the colony, was that of *The Cape Packet*, a vessel of 220 tons, belonging chiefly to Prosper de Mestre, Esq., a highly respectable merchant, of American origin, who has been long settled in Sydney. She had been out thirteen months, and brought in a cargo of 171½ tons, or 1,382 barrels of oil. She had thirty-three mariners, including the captain and officers, on board, and the voyage was considered both expeditious and successful.

"The colonial sperm-whale fishery is, comparatively, but of very recent origin. I do not think there were more than two vessels in the trade, out of Sydney, when I arrived in the colony for the first time in the year 1823. In the beginning of the year 1826 there were five or six, but in August, 1830, there were twenty-six. The number has been gradually increasing ever since, and it is supposed there will shortly be a hundred. The value of the oil and whalebone exported to London from the port of Sydney, in the year 1832, was 146,018*l*."—Vol. i. pp. 299-307.

This last piece of information reminds us that the doctor's first volume con-

cludes with an Appendix, containing the exports, imports, and expenditure of the colony, for 1832, which is the only statistical table given in the whole course of the work.

We have already remarked that vol. ii. is chiefly occupied with details of the doctor's own doings. Luckily, some of the earlier chapters contain accounts of his tours in the interior, which impart a good deal of information on other matters than his eternal quarrels with governors, secretaries, archdeacons, commissioners, chaplains, and all the other " eleven obstinate jurymen," whom the worthy doctor happened to come across. These pleasant diversions fill up the latter chapters almost exclusively, the said worthy doctor, apparently, never reflecting that a cold calculating public may grumble that a " History of New South Wales" should be so largely composed of matter " personal to himself." We quote from a chapter on the " State of Education in the colony" a passage which must naturally interest our readers, and which will, at the same time, answer the purpose of showing how unmercifully Dr. Lang lugs in, by the head and shoulders, allusions to his own labours and afflictions in the cause of Presbyterianism, however unconnected they may be with the subject in hand :—

" Another institution has lately been established in the colony, with every prospect of success. The institution I allude to is a Mechanics' Institution, designated 'The Sydney Mechanics' School of Arts.' The idea of its establishment was first suggested by his excellency Major-General Bourke to the Rev. H. Carmichael, A. M., classical professor in the Australian College. Various preliminary meetings were accordingly held, for the purpose of feeling the pulse of the public, and of making the requisite preparations, in Mr. Carmichael's class-room; and a general meeting was at last held in the Court-house, Sydney, on the 22d of March, 1833, at which the institution was formally organized, under the patronage of his excellency the Governor, Major Mitchell, surveyor-general of the colony, being elected president, and Mr. Carmichael vice-president. In the committee of management for the present year, I perceive the names of no fewer than five mechanics of the Stirling Castle importation.

" *The number and the influence of Scotsmen, in this and in other institutions for the* intellectual and the moral advancement of New South Wales, has given rise, however, to a series of attempts on the part of certain of the lower English in the colony to excite an illiberal prejudice against Scotsmen in general, through the medium of the press. But intelligent and respectable Scotsmen, who now begin to feel their own weight in the colony, and of whom there are not wanting individuals who can wield other instruments than the chisel and the saw, are not likely to sit silent and see so powerful an engine as the press in the hands of those who traduce them. To ascertain the degree in which the colony has been indebted to the efforts of Scotsmen, it is not necessary to go farther than the single instance of a mechanics' institution. Something of the kind was attempted by Archdeacon Scott; but with all the pecuniary means and political power at that gentleman's command, the effort proved abortive—the thing could not be effected, till a host of reputable and intelligent Scotsmen arrived in the territory. And yet, of all classes of the community in the Australian colonies, we are the class that must make the most desperate efforts, and submit to the most mortifying humiliation, ere we can obtain for ourselves the ordinances of our religion according to the customs of our forefathers. And if we are poor and cannot pay for the education of our children, Sir George Murray tells us, we must either keep them at home, or send them to the archdeacon's school to be made Episcopalians at the expense of Government."—Vol. ii. p. 389.

The " Sydney Mechanics' School of Arts" will doubtless prosper so long as its proceedings are untainted by party spirit. Unfortunately, in a small community, like that of New South Wales, this spirit, when once excited, rages with a virulence unknown in other situations. The School of Arts does not seem to have suffered hitherto from this cause, although it has interfered most materially with the interests of education in another quarter, where Dr. Lang himself figures as the hero. He has drawn much odium on himself, it appears, among some parties in the colony, by his conduct with respect to the " Australian college," of which he is now the " Principal," and, even according to his own showing, not without some reason. We cannot wonder that the supporters of the " *Sydney* College" should be both surprised and offended, when the doctor returned from a voyage to England, undertaken at a time when he was a supporter of that

establishment, bringing with him a liberal grant from Government in aid of a *rival* college, as well as a cargo of Scotch Presbyterian mechanics to erect the requisite buildings, and a bevy of Scotch Presbyterian ministers to act as professors! Whatever he may think, such conduct as this does not redound much to his credit; and, if his own statement inculpates himself thus far, what must those of his adversaries do? The doctor ought, in fairness, to have given some of these, instead of calling for judgment when he has all the say to himself.

We should not omit to observe that the second volume contains a chapter on the "Distribution, Employments, Condition, and Character of the Convict Population," and another on the "Advantages which New South Wales holds forth to various classes of emigrants of moderate capital," neither of which contains any thing very novel or important. The whole winds up with a very flighty lecture on emigration, as delivered by the author in the temporary hall of the Australian College, in May 1833. The only engraved illustration to the two volumes, is a map of Australia and plan of Sydney, borrowed for the nonce from the "Series of Maps" of the "Society for the Diffusion of Useful Knowledge."

THE IRON AND STEEL MANUFACTURES.

[From Minutes of Evidence before Select Committee of Manufactures, Commerce, and Shipping, 1834.]

Mr. S. Jackson, saw and steel manufacturer, Sheffield, examined.— Has visited many manufactories on the Continent, particularly those of Prussia and France. Ever since 1825 the hardware trades of these countries have been gradually improving. In the duchy of De Berg there are 800 saw manufacturers, 1,000 file manufacturers, 3,000 cutlers, 1,000 sabre manufacturers, and 1,500 scissor manufacturers. Some particular kinds of saws they can make fully as well as we can—such webs as are in chief demand on the Continent and in the American market. The English marks are frequently forged, both at Molsheim and at Remscheid. They cannot, however, make the circular saws, nor the hand saws, nor the back saws, nor long saws, as well as we can in England. The manufacturers of St. Etienne, in France, have made great progress, but considers them quite unable to compete with the English in the manufacture of any kind of steel or iron. If it were not for their high protecting duties, the French steel manufactories could not exist. The manufactures of the duchy of De Berg are those which come chiefly in competition with ours in the American market. The number of hands employed at the principal staple trades of Sheffield are as follows:—Table knives and forks 3,689; pen and pocket knives 2,680; razors 754; scissors 600; files 1,768; saws 363; edged tools 703; stove-grate fenders, &c., 1,530; white metal 643; silver-plated manufactures 500; making a total of 13,430. The hours of labour are ten per day. Wages are three times higher than on the Continent, averaging from 2*s*. 6*d*. to 5*s*. per day. The manual labour required in these trades is mostly very severe, which is probably the reason of the day's labour being shorter than usual. By industry and frugality an apprentice to any one of these may hope to raise himself to become a small manufacturer; in fact, our first manufacturers have themselves been workmen. There have been considerable improvements lately introduced at Sheffield. The manufacturers have employed machinery to as great an extent as they could. For instance, about a dozen or ten years ago it was necessary, in order to manufacture a three-square file, to forge it out of a square bar, but now by the aid of machinery they have bars of steel rolled three-square. Many of these improvements have not yet found their way into the duchy of De Berg; they have no rolling mills in that part of Germany; they have not so much machinery as we have; the only advantage they have over us is in the price of labour, which, in some branches of manufacture, is counterbalanced by our excellent machinery. The high prices of English goods has had a tendency to encourage similar manufactures on the Continent; and the combinations of our workmen have contributed not a little to their high prices. After a journey to the Continent, in 1826, witness obtained considerable orders for what are called billet-webs. We could at that time compete both with the German and the French manufacturers; but business being then extremely good, the workmen refused to manufacture the article ordered, excepting by a certain process which, being more expensive, rendered witness altogether unable to supply them. Since that, the French manufacturers have so much improved in this particular line, that competition is now out of the question. The articles of English manufacture which continue in greatest repute on the Continent, are edged tools, files, saws, and razors. English cutlery is occasionally smuggled into France through Belgium, but not so much as it is imagined. Never saw

any in private families, with the exception of an English penknife or razor. The shops of the Palais Royal exhibit what they call English goods; but which are, in fact, manufactured in France, and impressed with the English monogram, in order to obtain a higher price. Remembers a particular instance of a quantity of razors being manufactured in Sheffield for a merchant in Havre de Grace; and, in order to avoid their being seized, they were packed with a number of edge tools and put at the bottom of the cask. Those razors were marked *Pradier*, the name of a celebrated French manufacturer. Surgeons' instruments are manufactured in Paris, but they are much inferior to those made in England. Has seen in this country specimens of the finer articles of French cutlery; the blades of their scissors are not so good as ours, but the workmanship of the shank, which is of mother of pearl or ivory, is much cheaper and better than any thing to be met with in England. There has been a fall in the prices of Sheffield goods since the peace, of from 30 to 40 per cent.; in the cutlers' branch it has been still greater; yet, notwithstanding, believes the town has increased more than any other town in England in population and manufactures. Nearly all the Sheffield manufacturers are obliged to strike the names of their customers upon their wares, and that is one reason why no cutlery manufacturers in Sheffield can keep stocks; as they are uncertain who their customers may be, and as articles of hardware cannot be marked well after they are hardened, they are deterred from having a quantity made on hand, till they have orders, to see what impression they are to bear. A man is sometimes a journeyman one year and a master the next; a cutler with a few shillings can set himself up as master. There is very little cutlery made in London: some of the very fine and expensive sorts may be made there, but the greater part must come from Sheffield, as they can manufacture it there much cheaper. Believes it is not unusual for the word "London" to be stamped upon many articles made in Sheffield. The iron used in England for making the cast steel is the Swedish—that from the Dannemore mines. Believes that there have been considerable improvements of late in the manufacture of Swedish iron. Swedish manufacturers have been here, and have adopted many of our processes. Instances, Mr. Michaelson, of the firm of Michaelson and Company. Their iron (mark J. B.) brought, some years ago, only 24*l.* per ton, but Mr. Michaelson being in England, and having ascertained what sort of iron we wanted for our manufactures, he was enabled, on his return home, to *make such an improvement in the quality of the iron, that it* now sells for 32*l.* a ton. In the duchy of De Berg they have considerable iron mines of their own; but the quality of their iron being inferior, they mix it to advantage with iron imported from Siegern, in Styria, and Ensdorf, in Bavaria. For many purposes, the steel manufactured of this mixture is of an inferior quality to ours, which may be inferred from the fact of our exporting considerable quantities of cast-steel for the use of the foreign manufacturer of edged tools; but for other purposes their steel possesses more toughness and flexibility than the English steel. A considerable quantity of the French steel is made from the native iron, but it is not at all to be compared with the English. Has seen Swedish iron in France, but believes they cannot obtain a supply of the best marked iron. Some steel is made in England by the admixture of English iron with a small portion of foreign; but the practice is not increasing, as the price of Swedish iron is so low, that they cannot purchase English iron of so good a quality at as low a price as the foreign. Our manufacture of steel has been much improved of late years; in consequence of better processes, we can, at the same expense for fuel, produce a greater quantity of steel of a better quality. The chief export of cutlery from this country is to the United States of America, and to South America; there is very little legally exported to the continent of Europe. In the United States they cannot, owing to the high price of labour there, compete with the English in fine cutlery. In consequence of an *ad valorem* duty of 50 per cent. being imposed on the importation of mill saws, and some sorts of edged tools, they have made some progress in the heavier sorts of these branches of manufacture. The introduction of the Sheffield manufactures on the European continent has been much assisted by English artisans who have been induced to go over by the temptation of high wages, but have since returned. In starting a fresh manufactory there, it is universally the practice, especially in the iron trade, to employ a few clever English hands; but after their own workmen have acquired a competent degree of skill and knowlegde, the English hands are turned off as more expensive. Mr. Cockerill, a large manufacturer at Liege and Seraing, employed a great many Englishmen when he commenced his manufactory, but believes most of them have returned to England. He had to pay for English workmen 7*s.* and 8*s.* a day, and his native workmen get only one and two francs a day. It requires a very long time, however, for a man to learn the art of making the superior sorts of cutlery, and there are some particular branches in which very few workmen ever attain to excellence.

NOTES AND NOTICES.

Mosselman's Zinc.—Mills for the rolling of this valuable metal have been erected at Dartford, and commenced working on Saturday last. The event was celebrated by a *fete champetre*, which was attended by a number of the most distinguished merchants and shipowners of the city of London, several eminent engineers, men of science, &c. Mr. Ward, late member for London, in proposing the health of Mr. C. P. Chapman, the manager of the establishment, spoke in high terms of the serviec which Mr. C. had rendered to the country by the introduction of so cheap and efficient a substitute for copper in the sheathing of ships, at a time when economy of expenditure is an object of such vital importance to the shipping interest. The demand for zinc for this purpose is, we understand, increasing with astonishing rapidity; and hence the importance of having rolling mills so near the metropolis, where sheets of any thickness or size can be turned out as fast as wanted. The machinery of the mills has been constructed by Messrs. Hall, the eminent engineers of Dartford, and is of a very complete, though necessarily simple, description.

At a sitting of the French Academy of Sciences, on the 16th of June last, M. Thilorier presented for inspection a machine for obtaining chemically, and in a short time, a quart of carbonic acid. The memoir presented a variety of experiments upon this almost untangible liquid, since it can only be procured in vessels hermetically sealed. The author affirms that in gases the pressures at different degrees of temperature do not correspond to the densities, as is generally believed. Liquid carbonic acid, he says, is of all bodies that which dilates and contracts itself, the most under the influence of atmospheric variations of temperature. Its enormous power of dilatation points it out as a new principle of movement, far more powerful than any hitherto applied. Can one imagine the force a number of horses that would be represented by a metallic rod, a metre square (about 3 feet 3 inches), dilating at the rate of a metre per second? And yet this is the force produced by thirty quarts of the liquefied gas, with an expense of heat forty times less than that required to evaporate a quart of water. It is also the liquid that produces the greatest depression of temperature. Directing a jet of it on the ball of a thermometer of spirits of wine, it reduced it to 75° below zero, the greatest depression heretofore observed being 68°. M. Thilorier intends to apply this liquid to the air-gun.—*Athenæum*.

Bess Drake was a seamer in London who first introduced the mode of embroidering hose with the needle. However simple it may appear, to run the needle through the stocking and form figures, it was done on the frame, by the hand, a century before it was done with the needle; it is still practised by Spaniards, who make clocks of a very superior quality, which are sold at 25*s*. per pair in our markets. Bess Drake was a woman of singular habits, and, like too many London females, loved gin and purl; she worked many years for Mr. Hardy, the inventor of the caster back, who used to express the utmost detestation for her as a gin-drinker, yet, such is the mind of man, at the age of eighty-three, he married this very object of his disgust, and she lived with him till he died, in the Framework Knitters Almshouses, Kingsland-road. Bess had been married once before; having met with a handsome sailor, they agreed to be married, and were spliced by one of the Fleet parsons; they took a ready furnished room, but in the morning her husband had departed, taking with him all her clothes, and leaving her naked. Bess, from this time, formed no male connexions for forty y and the world was as much surprised at Bess rying old Hardy, as they were at old Hardy m ing Bess.—*Henson's History of the Frame Knitters.*

An address has been forwarded by Lord Sa rez to the King signed by 687 of the princip habitants of Weymouth, in which they earn solicit his Majesty's countenance and suppo Mr. Harvey's project of forming a breakwat Portland-roads. The *Guernsey Star*, after ring to the facts cited in this journal, No. 5 favour of this important undertaking, ad "Besides the thousand vessels there allude which anchored during the heavy gales o winter of 1833-4, two thousand more thered St. Alban's Head, to avoid the flood being bound to the westward, otherwise, i probability, they must have been carried again to the eastward, little short of the I Wight."

Steam Communication with India.—Mr. C. explained to the House of Commons, on M last, that though 20,000*l*. had been voted to d the expense of a trial of the line by the Eup and Persian Gulf, it was not expected that line would be practicable for more than months in the year, but that those eight m would include June, July, August, and Septe during which the passage by the Red Sea is stop to by the south-west monsoons; and t all probability, a regular communication ov with India, could only be accomplished b availing ourselves of both routes alternately. substitution, however, of two routes for one increases the difficulties attendant on the east passage to India, and furnishes another p ful argument, in addition to those mention our last Number, for cultivating a direct communication with India by the Cape of Hope.

Portland Breakwater.—The importance o a harbour, with regard to Cherbourg, would estimable. Should this breakwater, as ha proposed, extend 12,000 feet into the sea, a modation would be given to a large fleet. not without its value, too, in reference to and more particularly now that steam has such facility of aggression on a long extent protected coast. With regard to Cherbourg, force with which, in the event of war, we shoul to mask it, every one naturally turns to Pl and its breakwater for security; but few h served the insufficiency of the boasted brea and that it can only shelter sixteen line-o ships, with a proportionable number of friga sloops; whereas the breakwater of Cherb calculated to protect forty-two line-of-battl besides the necessary quantity of smaller The length of the breakwater is 4,475, that dique 12,362, and the area of the anchorage they respectively cover is nearly proportion deed, it is admitted that the comparative v space and dimensions of the two works is to one in favour of Cherbourg.—*United Journal.*

Communications received from Mr. Bad Mentor—Tubal Cain—R.—C. T. S.

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IMPROVED WHEEL-CUTTING ENGINE.

Fig. 3.

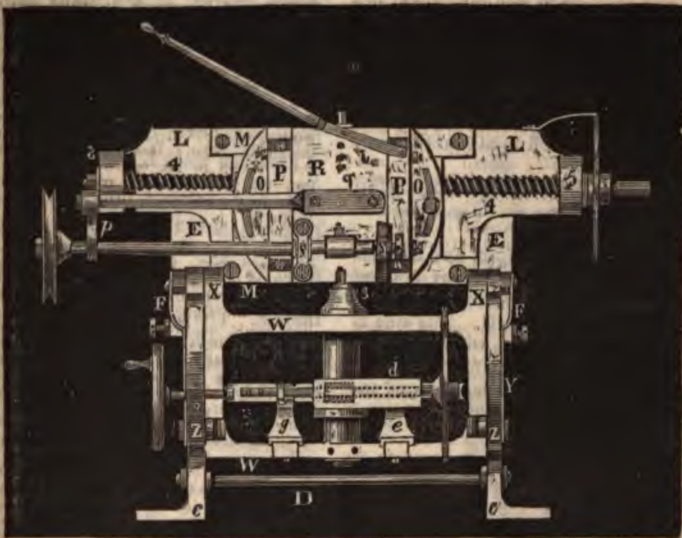
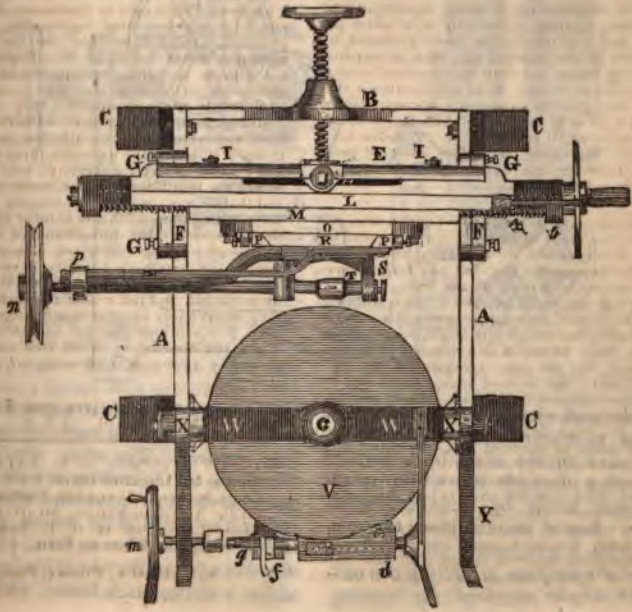


Fig. 1.



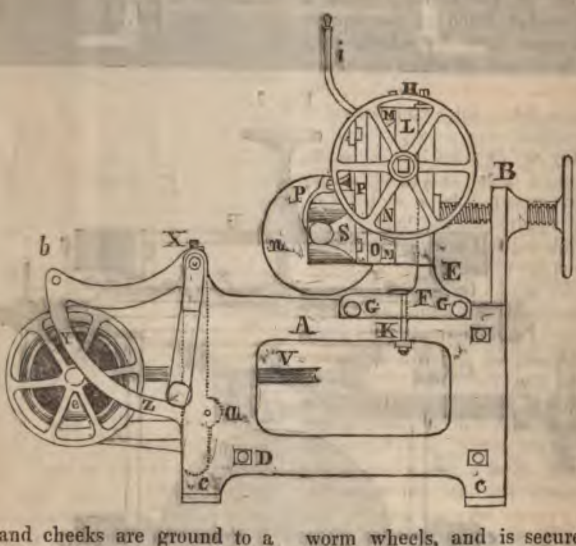
IMPROVED WHEEL-CUTTING ENGINE.

Sir,—In conformity with my promise, I now hand you drawings of an engine for cutting wheels, &c., which I have finished and got to work, and as I think it offers some advantages beyond the powers of those in general use, I wish to make it known through the medium of the Mech. Mag. The general plan of the engine was suggested by Mr. Child, but I have made several additions that subsequently occurred to me in the progress of my work.

Fig. 1 is a plan of the apparatus. Fig. 2 a side elevation. Fig. 3 an end elevation.

The frame is of cast-iron, and consists of two sides A, connected by a third side B, strongly screwed together, and standing upon four feet C. The side B has a raised part, through which passes a screw, as in fig. 2. The fourth side is open, and the frame is then secured together by a bar D, as in fig. 3, screwed tight up to the shoulders. The sides A are set very accurately parallel to each other, and the edges worked true for the upper frame to slide upon. The foundation part E of the upper frame has two feet or sliders F, having correcting screws G to keep it in its true line of direction, and when brought to the required position, by the back screw through B, it is secured by screw bolts K to the lower frame. On the face of the part E is fixed the piece L, carrying the slides, &c. It is made so as to fit upon the ends of E (which are worked true for the purpose), and to slide up or down vertically by means of the screw H, being fixed to the main piece by set screws I, which traverse in vertical grooves cut therein. The slide cheeks M are screwed on to L, the lower one having tightening screws; within these works the first slide N, one end of which is shown in fig. 2.

Fig. 2.



The slide and cheeks are ground to a true face to receive the piece O, which is connected to the slide by a conical part passing through it, which is attached very firmly by three screws to the slide. Round this the piece O turns, and carries a graduated plate on one edge, for the purpose of setting the cutter at any angle required for cutting worm wheels, and is secured in its position by set screws working in concentric grooves. The slide cheeks P are attached to O, having set screws, and betwixt them is the second slide R, carrying the studs S in which the cutter arbor runs. The engine plate V is fixed in a frame W, which fits between the sides A of the main frame, and traverses

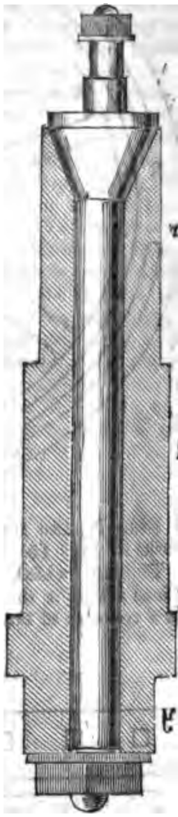
upon centre bolts at X, when bevilled or face wheels are to be cut, the arm Y carrying a graduated scale. In these cases the frame is secured by the screw bolts Z, which traverse with the frame. There are home pins at *a* fig. 2, and its corresponding position on the other side, which pass through both frames, and determine the vertical position, and when face wheels are wanted, the angle of 90° is ascertained by their being transferred to the holes (*b*) at the extremities of the arms.

The periphery of the plate is cut by a screw tap into 360 notches, in which works the endless screw shown at *d* fig. 1, which traverses upon a pivot screw in the pedestal (*e*) having a spring to throw it out of gear when the catch (*f*) is raised. The pedestal (*g*) has a groove in it, in which the screw arm slides, and the catch fits over it and secures it close to the plate. The pedestals are fitted and screwed to arms cast on and projecting from the swing frame.

The wheel *m* (of wood) carries a key with a socket fitted to the square end of the screw arm, by which it is turned and is slipped off when the screw is set, to prevent accidental motion, being removable when the swing frame is traversed.

The pulley *n* is fixed on a shaft, which screws on to the end of the cutter arbor. It is supported by a socket (*p*), fixed on a square at the end of the bar (*q*), which is itself screwed firmly on to the outer slide above the arbor studs. The lever (*i*) works on a pin screwed into the cheek of the slide, and has a hole allowing of sufficient play for a pin fixed in the slide, by which it is moved up or down, and the same pin may be put into different holes as greater or less motion is required. Fig. 4 shows a section of the plate arbor, and that which fits in it, and carries the wheel to be cut. The part *r* fits into the upper bar of the swing frame very accurately, and the shoulder works under the bar. The next portion *t* carries the plate, which is secured by three small screws, and rests on the shoulder (*u*). *y* shows the part which fits into a collar of bell metal, which again fits tightly into a hole in the lower bar of the frame, and is kept up firmly by two conical pins which pass through the bar and catch hold of the collar, making the arbor perfectly secure, and giving the means of tightening it, if by long use it should acquire too

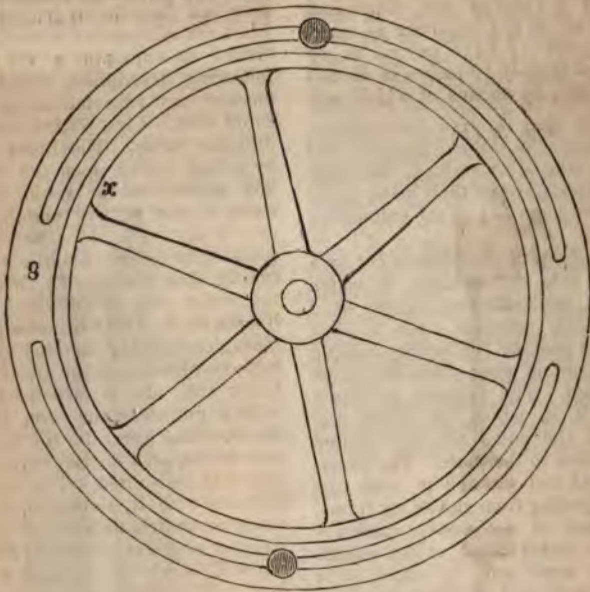
Fig. 4.



much play. The part *z* is merely a cap of brass to keep dust from the arbor socket. I should observe that the plate is graduated on the face close to the edge to 360°, corresponding to its screw.

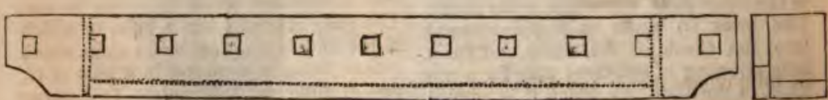
From the foregoing description it is evident that spur, bevil, face, and worm wheels can be cut by this machine, and by an addition to the front slide, annular wheels also. I now go to the method of cutting racks, which is done by means of the horizontal screw 4, which crosses the main piece L, and lays in a channel taken equally from the substance of it

Fig. 5. (*a*)



and the first slide N, and the ends are turned and work in lugs (5) cast upon the piece L. The nut which works on the screw fits into a hole in the slide, and by that means a traverse of ten inches is obtained for the cutter, which will consequently cut a rack of that length, without any necessity for moving the rack when once fixed. Fig. 6 (plan and end view) shows a frame of cast iron, which

Fig. 6.



crosses the lower frame and rests on the sides A, to which it is fastened by screw bolts. The top has a row of square holes to receive the clamping screws for fixing the racks. A micrometer wheel fits on one end of the horizontal screw, and a similar one on the endless screw of the plate. Each has a flange (x) upon it (as shown in fig. 5, a plan and section), upon which fits and turns a flat circular piece (8) of equal diameter with the wheel. This has two grooves, admitting *of a traverse of about* 160 degrees, in each of which passes a screw, having a nut to secure the peripheries to each other. Each is graduated to 360 degrees, so that when any fraction of that number has to be pursued in the cutting of a wheel, by loosening the screws and bringing back the traversing periphery till the first graduation come to the index pointer, the degree wanted can be pursued throughout the process with less probability of error in counting or recording the progress.

The divisions obtainable by the end-

less screw and its micrometer wheel of 360 degrees being numerous, admit of the use of a plate of less dimensions than common, as not requiring so many circles of holes. I have put on to my plate, which is only 10 inches in diameter, 26 circles, by means of which, and

Fig. 5. (*b*)

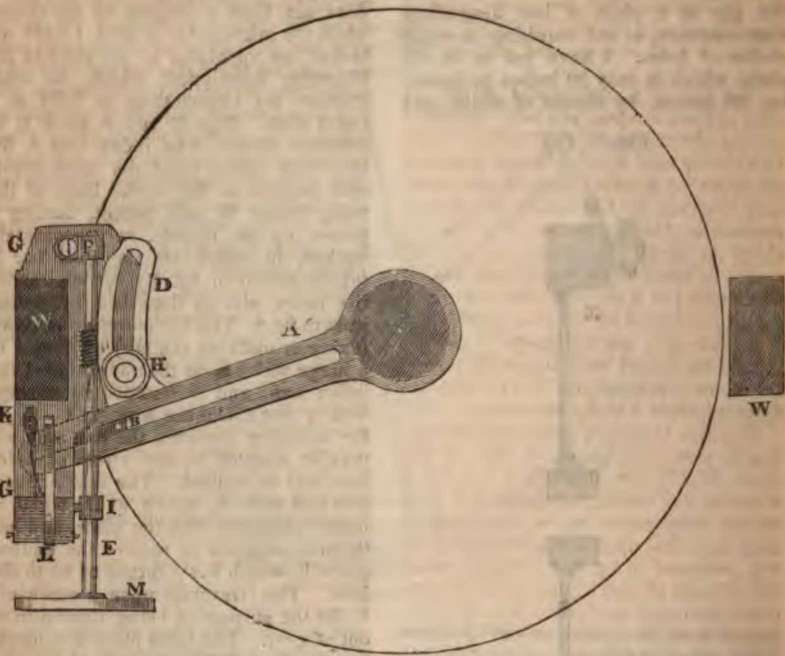
the micrometer screw and wheel I have yet to describe, together with the plate screw, I can obtain any number, without exception, from 2 to 237, and betwixt the latter and 360, at various intervals, 24 more numbers; with many others above that, given by fractions of a turn of the micrometer of 360, which are hardly likely to be required for any purpose.

The numbers that I find most eligible for my engine, are 228, 222, 220, 216, 208, 198, 190, 182, 174, 164, 156, 146, 138, 126, 118, 112, 70, 68, 67, 65, 62, 61, 53, 49, 47, 43, which, combined with the screws, afford scope sufficient.

Not approving of Hindley's plan of an index pointer, on account of its complexity, nor of Rehe's, because the index does not form a tangent to the circles when the micrometer is used, I have attached an apparatus to my plate of the following description, which, on trial, answers my expectations as fully as I could wish. Figs. 7 and 8 show it in different views. The index arm A fits by a deep collar upon the main arbor, and projects so far as the limit of the swing frame W will permit, having a groove up the middle, very accurately worked, in which fits the steel bar B (partly shown in fig. 7), which carries the index pin, as described by dotted lines in fig. 8. This bar moves up or down (fixing or unfixing the pin) by means of a hinge which is on the under side of the index arm, and is fastened by a screw with a nut above the arm, at C, fig. 8. By loosening the nut, the bar and pin may be adapted to any circle of holes that may be wanted. The arm A has a part cast with it, shown at D, which is made concentric with the plate, and has its outer edge cut to receive the endless screw E, which has a thread of 40 to the inch. This traverses upon a screw-pin F, for the purpose of being thrown in or out of gear. The brass plate G is firmly fixed to the swing frame, and carries the screw and its apparatus. A screw-pin is fixed in G, shown by dotted lines in fig. 8, and goes through the arm D into a groove cut threin, and has a nut H by which D is secured in any position when the micrometer screw E is not in use. The piece of steel I has a hole, in which E fits and turns, and has a stem which passes through a socket in a part of G, cast of sufficient thickness. The spring K works against a pin which projects from the stem of I, and draws the screw out of gear when the catch L is raised. This catch moves on a pin shown by dotted lines in fig. 8, and when put down goes into a groove cut through the brass and into the stem of I, pushing the screw into gear in the arm D. To do this it is made in the form of an inclined plane in a manner obvious to any workman.

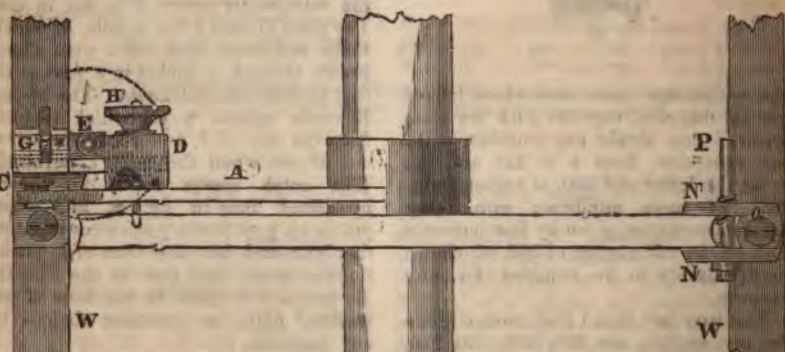
The micrometer wheel M is graduated to 60 degrees, and its index pointer, of sheet brass, is fixed on the part I, and bends up to the top of the wheel, though not shown in the figures.

Fig. 7.



For the purpose of securing the division-plate from any vibration during the cutting of the wheel, especially of the larger sizes, I have adapted jaw clamps N working upon a pin O, which is screwed into the frame W, fig. 8, the

Fig. 8.



bolt P having a screw-thread upon it only where it acts upon the upper jaw, *turning upon a cylindrical part in the lower one, to which* it is attached by means of a shoulder above and a nut and pin below. The upper end of P is squared to receive a key, half a turn of which will fasten or release the plate.

The centre of the screw-pin O being opposite to the centre of the thickness of the plate, admits of the jaws pressing equably upon it, without liability to twist it from its true position, and relieving the index pin from all strain.

The use of a micrometer screw, as attached to an index, is so fully explained in the descriptions of Hindley's and Rehe's engines, that I will not lengthen my letter by entering upon it, and shall only observe, for the benefit of amateur mechanics, that by its means I was enabled to divide my plate into the 26 circles of holes before mentioned, having previously put a circle of 216 upon it by the endless screw of the plate itself—and this circle gave me the means of obtaining all the others with the index micrometer, and consequently all the intermediate numbers without exception.

The arm D gives a range of a twenty-fourth part of a circle, so that by the circle of 228, for instance, I can cut a wheel of 237 teeth, thus gaining 9 teeth by the micrometer screw. I ought to state also, that upon the index arm A, as it is presented in fig. 8, I have the number of holes of which each circle is composed engraved opposite to it, so that the pointer can be shifted to any of them without fear of mistake.

A strong trussel or platform carries the engine, which is screwed down by bolts through the feet. It is made of such height as is most convenient, and has a drawer underneath, for containing any tools or spare apparatus.

The foregoing details will appear tediously minute to the experienced mechanic, but I give them chiefly for the use of my brethren amateurs, and make no apology on that score. I am, Sir,

Your obedient servant,

R.

Halifax, Aug. 2, 1834.

OPENING OF THE WHISTON BRANCH RAILWAY ON THE UNDULATING PLAN.

My dear Sir,—I am happy to inform you that the *Whiston Branch Railway* (a section of which I published some time ago in your Magazine) will be finished *this* week. It was laid down upon my principle, though not in several curves, as I proposed to the Directors, but in one extensive undulation. The dip is *greater than I should recommend for general adoption, but it will* at all events afford us an opportunity of trying a series of interesting experiments, upon the result of which the undulating theory must stand or fall. I think it probable that the first series of experiments will be made on the 14th inst., as it is the earliest day we can appoint after the railway is completed; and it is our wish to complete the trials, if possible, before the line is used for general purposes, as we may naturally expect the road (being new) to deteriorate in condition for some time, by the sinking of the embankments, &c., and we are anxious to try our experiments when it is in the best order. I regret exceedingly that the uncertainty which existed as to the period when the line of road would be completed, prevented me sending this letter in time for publication on Saturday the 8th, and the more so, as I pledged myself to give due notice in your Magazine before the trial of further experiments. I trust, however, that the reasons which I have assigned will prove sufficiently apologetical for this unavoidable breach of promise.

With regard to Mr. Cheverton, Junius Redivivus, Kinclaven, S. Y., and to others (residing in London) who took a part in our recent controversy, I may still through your kindness be enabled to convey a timely notice. Would you, therefore, do me the favour to permit your clerk to write a note to each, stating, with my compliments, that it is our intention to try a series of experiments on the 14th or 15th inst., on the Whiston Branch Railway, and on one of the inclined planes on the Liverpool and Manchester line, on which occasion I shall be as happy to meet my opponents as my friends—adding, that should it be inconvenient for any of them to attend, I shall be happy to try any experiment which may be suggested, if the particulars are forwarded to me by next Monday's post, addressed to the Star and Garter Hotel, Liverpool.

In any event, I will not fail to send you a faithful account of our proceedings. I am,

My dear Sir,

Your obedient servant,

RICH. BADNALL.

Farm Hill, near Douglas, Isle of Man,
Aug. 6, 1834.

[See note, last page, on the subject of the preceding letter.—ED. M. M.]

INTERCEPTION OF FLAME BY MESHED FABRICS.

Sir,—I am disposed to believe, that when Sir Humphrey Davy discovered the peculiar property of wire-gauze to withstand the passage of flame, he was not aware that *combustible* and *non-conducting* substances, in a similar state, have a like power. In some recent experiments, I have found that flame will not pass through the apertures in card, paper, lace, &c., even when the apertures are of considerable magnitude, which would go to prove that the principle laid down by Sir Humphrey Davy—that flame cannot pass through apertures of small diameter—is really a universal law.

I have some difficulty in reconciling the above facts with Davy's explanation of the phenomena. He said the flame was prevented from passing through the wire-gauze in consequence of its being a *good conductor* of heat, and therefore cooling the flame below the point of kindling. As the wire soon becomes red hot, it is difficult to understand the *cooling effect*; but it becomes still more difficult of explanation when non-conducting substances are employed, which abstract little or no heat, and yet most effectually oppose the passage of flame.

From a consideration of these facts, it would almost appear that the ultimate atoms of flame are of considerable determinate magnitude, and also that they are held together by a cohesive force of such energy as to prevent their being easily divided.

Is the *smallest* body of flame noticed, as in the combustion of fine thread, composed of more than one atom? Because there appears to me to be some relation or correspondence between the size of such flame, and of the apertures capable of excluding flame.

I remain, yours respectfully,
WILLIAM BADDELEY.

London, August 5, 1834.

[We subjoin an extract from a very ingenious and interesting pamphlet, by Mr. John Murray, F. S. A., F. L. S., published 1833, entitled "Practical Observations on the Phenomena of Flame and Safety Lamps," from which our esteemed correspondent Mr. Baddeley will perceive, that the fact of flame being intercepted by other meshed fabrics as well as wire gauze, has been before this matter of frequent observation. Mr. Murray complains that his experiments on this *subject, though long ago made known to the world, have not been appreciated as they deserve by scientific men.* And well he may, since apparently they have been slighted for no other reason than that they happened to be at variance with the doctrines of the great scientific authority of the past age—Sir Humphrey Davy, although these doctrines, as far as regards the matter in hand, are now almost universally admitted to have been extremely fallacious.—ED. M. M.]

"The wire gauze can be supposed to *cool* the flame only in two ways—either by *radiation* or *conduction*. Though it should be granted, *causa argumenti*, to wire gauze at the 'common temperature,' it is not quite so evident how *red hot wire gauze* could cool down flame, and intercept its passage, though I have had the safety lamp *red hot* in the passages of the mine* where an explosive atmosphere prevailed. In a very early stage of this inquiry, I found that sieves of *pasteboard*, *haircloth*, and *muslin*, intercepted flame; and in 1818 proved these facts experimentally, in my public lectures at the Surrey Institution. These being non-conductors of caloric, it is evident that the question is reduced to the alternative of *radiation*, and this in them is not sufficiently powerful to account for the phenomenon. Since that period I had a net-work tissue of transparent *glass*, and found that this, in like manner, intercepted flame. I dipped a piece of muslin into a solution of *phosphate of ammonia*, and having dried it, formed it into a safety lamp, when it was proved to be as safe, when immersed into an explosive atmosphere, as one of wire gauze. Signor Libri, of Florence, accounts for the phenomenon of the safety lamp on principles altogether different from those of Sir H. Davy. Flame, he observes, is repelled by metallic surfaces, and that to a certain extent; if two parallel wires be brought within a specific distance, this repulsive void will be maintained, and flame will not pass through. He, therefore, finds that parallel wires will as effectually intercept flame as when woven into meshes. Mr. Dillon's (of Belfast) improvement on the safety lamp consists of a shield of *talc*, forming an external semi-circular attachment, and its object is to PREVENT the cooling of the lamp by screening it from the current of air which flows through the passages of the mine, in the process of ventilation; he has thus shown that *gas* may be safely burnt in the lamp. It seems, therefore, evident that the principle of safety cannot depend on any cooling influence whatever, whether it be connected with conduction or radiation. Accordingly it is found that when the safety lamp is newly lighted, and is consequently more cool than at other times, it is very apt to explode the air of the mine, and will kindle a stream of hydro-carbonate, under such circumstances, even when *six folds of wire gauze interpose*, while it will not permeate ONE such fold if the lamp be HOT. The rarefaction or attenuation of the inflammable and explosive atmosphere seems to be the real truth of the case.† When an explosive atmosphere is condensed, its explosive powers are more forcible, and its range more extensively destructive; on the other hand, when it is rarefied or attenuated, its violence is proportionably diminished. The heated walls of the wire gauze which imprisons the flame will attenuate the elements of explosion, and they will become feeble in consequence. The Chevalier Aldini's fire-proof apparatus, recently introduced, renders altogether problematical, if not entirely nugatory, the cooling theory, though the repeated objections we brought against it, from the period when the proposition was first started, had been entirely disregarded. Aldini's experiments made

* "It providentially happens that the 'fire-damp' of mines is among the least inflammable of the gases, or, more correctly speaking, the least susceptible of inflammation."

† "I purposely overlook the experiments of Von Grotthus, as not affecting this question."

va, and since repeated at the Royal Insti- seem to have startled the advocates of the eferred to, and seeing that cloth of amian- non-conductor, *cooling by conduction*, the t was struck in past times, is abandoned, cooling influence as a *radiator* is now con- or. The latter is just as powerless as the Why should Chevalier Aldini's experi- proving that flame would not pass through hes of amianthus cloth, make those who for the cooling theory, more restless than eriments with meshes of *hair cloth*, *paste-* tc., publicly exhibited in 1818? Their na- precisely the same—they are equally averse eory that has been indulged in, and so long with remarkable tenacity."

RVATIONS ON THE MAGNETO-ELECTRIC RING.

—I hear that attempts have been to realise the idea of your in- s correspondent φ. μ., since the ant discovery was made, that elec- can be developed and chemical ments performed by means of tism, but as yet with indifferent s. Indeed no experiments on a ently large scale have been at- ed. For making experiments on -magnetism on a large scale, a stance of much importance has een attended to, and has been oked by your correspondent. It is nown that the larger the surface n which is presented to the wires, greater will be the intensity of tism developed, as the magnetism wn to be confined to the surface of . If we get two pieces of similar or two rings, one of which will be the weight of the other, the pro- n between the surface of these will be considerably less; the con- ce is, that with a large ring there t be a sufficient quantity of wire on it without putting it on in too thicknesses, so that the outer coils far removed from the iron. Four esses at the utmost is the most an be effective. The celebrated can magnet (electro) was made of inches square. This presented a r surface, weight for weight, than iron. I would beg leave to sug- o your correspondent, to make the ring or rings of iron 1 inch in ess, and 6 or 9 inches in breadth, in the form of the iron rim of a . Two or more of these rings, for me reason, would be more effective than a single ring of the same weight. Indeed, in the making of artificial magnets this principle of having a large surface of metal is attended to, as they are generally made of iron, a cross section of which is oblong. There can be little doubt, if experiments on a large scale, in this branch of philosophy, were made, they would lead to results of a very important description.

I remain, Sir,
Your humble servant,
MENTOR.

ROUND-TIRE WHEELS OBJECTIONABLE.

"Then of the exterior I safely may say
There never was yet any carriage more gay;
While the *round-tire wheels* make it plainly appear,
That there's none run so light as the smart Shillibeer."

Sir,—The above extract from a doggrel advertisement of the celebrated omnibus-man, refers to an opinion, very prevalent of late among unscientific roadsters, that wheels with convex or semicircular tires run lighter than those equipped with tires of the usual flat cylindrical form.

If our roads were infinitely smooth and hard, no doubt wheels of the form in question would run very light; but in the present state of roads—good as they now are—it must be evident to all who carefully consider the matter, that cylindrical faced wheels are best.

The round-tire wheels cut into the road much deeper than flat ones, and have a greater hill constantly before them.

The omnibus in question is not the only vehicle that is equipped in the manner stated; several stage-coaches, and some of the mails, are furnished with round-tire wheels. On looking at an Exeter mail the other day, I observed that one of the hind-wheels, with round tire, had been locked and dragged down a hill, which had ground the tire *quite flat* in that particular place, and this must always occur under like circumstances, from the small quantity of surface supporting the weight and exposed to the grinding action. By the use of a shoe, however, this could easily be guarded against, but there are many other objections not so soon obviated.

The question of broad *versus* narrow wheels, has long since been disposed of pretty satisfactorily; but its application, in point of principle, to the use of *flat tires* in preference to *round ones*, does not appear so plain to modern wheelwrights as it should do.

I am, Sir, yours respectfully,
WILLIAM BADDELEY.

London, August 6, 1834.

A FEW WORDS IN BEHALF OF MATHEMATICAL SCIENCE.

Sir,—Will you permit a foreigner (a Swiss) to make a few remarks on Mr. Cheverton's article on the value and importance of mathematical science.

In the first place I must state, that had it not been for the false aspersions he has heaped upon some of the most illustrious of my countrymen, and more particularly on that excellent man Euler, I should have left him to enjoy all the honours and benefits that may arise to him from the said article.

In the first observation he makes upon Euler (No. 572, p. 277), he says, "the most valuable method of determining the longitude was at last accomplished through practical means and by practical men. Euler aimed to produce an achromatic lens as well as Dollond, but it was the latter who succeeded; and their respective modes of proceeding mark both the character and comparative value of their efforts."

Well, in all this there is, perhaps, nothing very extraordinary (upon the supposition that Mr. Cheverton's statement is true). Euler belonged to that useless race of men called mathematicians (according to the Chevertonian philosophy), and Mr. Dollond (Mr. John Dollond I presume he means) was certainly a first-rate optician; not only so, but *also* (much to his discredit, no doubt) a clever mathematician and an able astronomer.

Mr. James Gregory, professor of mathematics in St. Andrew's, as it appears from his "Optica Promota," showed how a telescope with specula might be constructed; but this unfortunate mathematician being neither an artist, nor *having any turn* for practical mechanics, *was himself* incapable of realising his own invention by an actual construction, although he had demonstrated that to form a perfect image of the object the speculum must have the form of a parabola. I might here, Mr. Editor, pause to inquire, whether the arts or sciences at this period were in advance; but the question would carry its answer along with it. The unfortunate Gregory could not find a single artist in his own country that could grind a speculum for him. Poor Scotland! this appears to be a stain upon your escutcheon. But why, it may be asked, did not Gregory apply to some of the English artists? The answer is easily given. They were not, at this period, one jot farther advanced in the arts than their northern neighbours.

Soon after the period just alluded to, the immortal Newton found himself compelled to relinquish for a time his philosophical pursuits, and betake himself to the mechanical art of grinding specula. His first attempt was to construct a reflecting telescope, according to the principles of his friend Gregory, that is, with a parabolic speculum. In this, however, he did not succeed; but he succeeded in making two reflectors with his own hands, which he presented to the Royal Society in 1672, the great speculums of both being of a spherical figure, although he was fully aware of the superiority of the parabolic form. During the interval he was employed in making his reflectors, he tried his hands upon constructing a refracting telescope, which had been prepared by Descartes, the object of which was to *grind the lenses* into one of the figures of a conic section; and when employed in this pursuit he made his grand discovery of the various refrangibility of the rays of light, from which he concluded, that the errors arising from the spherical figure of the lens were small in comparison with those which arose from refrangibility. He, therefore, gave up the attempt of constructing refracting telescopes, considering that the devergency of the rays of light, arising from the difference of their refrangibility, was always in proportion to the refracting powers of the medium. In consequence of this opinion of Sir Isaac Newton, respecting refracting telescopes, all attempts to construct them free from the effects of refrangibility were, for a pe-

nearly seventy years, laid aside. 'er, some time about the years r 1741, Mr. John Dollond, after optical experiments, discovered ie refractions of two prisms, when of different kinds of glass, might al, and that the difference of their gibility might be considerable; iat there might be equal diver- with different degrees of refrac- in short, that refraction might be ed without colours. Acting from principles, Mr. Dollond was the tist that produced a correct achro- refracting telescope. And here I sk Mr. Cheverton if the odium, he attaches to Euler on this head, not on all these accounts to have athered upon Newton? ait for his reply. I have lots more e for him.

I am, Sir, yours, &c.

LEWIS FREND.

hn's Wood, Aug. 9, 1834.

s OF ARCHITECTURAL DEFORMITY LONDON—ALSO A FEW MORE OF LIMITY.

—I hope you will find a place in next Number for a few remarks, have been suggested by a perusal r last.

he very interesting article on the of York's column, by Mr. Robert- . C. Robertson?*), with which the er opens, I am afraid that the has been withheld by a feeling of cy from making any remarks not nmendation of the new edifice, vise a writer of his taste would not have omitted to censure the oor effect of the "plain substantial ailing" which crowns the capital. , if ever there was a situation for nificent iron railing, this, on the a column which is visible from so different points of view, was the me. During the progress of the ng, I always anticipated seeing, on pletion, a specimen of English iron which would make the Parisians ly ashamed of the shabby abortion disgraces the summit of their own splendid monument in the Place Vendôme: the defect is one which might be remedied, and ought to be. One defect, which is irremediable, is the want of height in the column altogether. The wood-cut in your front page shows it in a point of view in which this does not strike the observer; but in surveying the statue from Trafalgar-square, from various points in the Park, or, in fact, from any spot where houses interpose between it and the eye, it will be found that so little of the pillar is visible, that the Duke of York has the appearance of a chimney-sweep just emerged from durance vile.

Mr. Robertson has, however, tacitly conveyed a condemnation of the petty scale of the new column, by informing us that it is not only inferior in dimensions to the monument on Fish-street-hill, and likewise to Trajan's column, and the pillar of the Place Vendôme, but to the new monument of the same description lately erected at Edinburgh in honour of Lord Melville. The size of such a building as the Post-office, or the Exchange, must, of course, be determined by its uses; but the only use of a commemorative column being to "cut a figure," it strikes me as an instance of the very worst possible taste, to erect, in the largest and most populous city of the world, the most diminutive specimen of the genus. It is a mark of poverty in the mind, if not in the pocket; and a woful instance of the architectural "shabby genteel." Had I been of the Duke of York's committee, I would have voted for a colossal statue rather than a pigmean column.

One other remark, and I have done with this subject. How is it that, while the liberal press makes so great an outcry about the tax levied on the visiters of St. Paul's and our other public buildings, it is allowed to pass unreproved that this York column is only "open to the public" at a shilling a head. The other taxes have at least long use and prescription to plead in their favour; this is one which has no such excuse, but is allowed, nevertheless, to be exacted without condemnation. I am afraid this one-sided sort of zeal is getting to be "the spirit of the age." While Mr. Slaney was making a fuss about establishing public walks at vast expense, an act had nearly passed the Legislature to enable the proprietors of fields to stop up all

*—but a very ingenious writer, of the same who corresponds both with the Architectural and the Mechanics' Magazine.—ED. M. M.

the field paths throughout England, "without judge or jury." We may expect, I suppose, some day or other, to see the royal assent given to two bills,—one for abolishing the poor laws in England, as incalculably pernicious, and another for establishing them in Ireland, as the only means of saving the country.

Mr. Steele praises, with justice, the effect of the view of St. Paul's appearing over the gigantic arch of Southwark-bridge; but fine as it is, London can, I think, show a still finer. I must own that on me an iron arch does not produce that impression of strength and grandeur which a stone one of any size seldom fails to do. The view of *Waterloo-bridge* from Hungerford-market-quay, with St. Paul's appearing over its centre, is to my mind the most magnificent in London; and must be, I suppose, as magnificent as any city view in existence. It presents what is acknowledgedly the finest bridge in the world, crossing one of the finest rivers, and surmounted by one of the finest churches—the second at least, if not the first, in external appearance, that the world has ever produced. The only drawback to the general splendour of this extensive scene, which comprises the chief objects in the metropolis, is the shabbiness of the buildings on the other side of the river immediately fronting Hungerford-market. But at the end of Whitehall-place, the street which leads from Whitehall, opposite the Admiralty, down to the river-side, all the main features of the view might be enjoyed, were some trifling obstacles removed, while the intrusion of these "detrimental" objects would be presented by the line of the houses. And this leads me to speak of what has long been a favourite project of mine for adding to the architectural glories of the capital. Were the Admiralty, a very contemptible building, taken down, and a few houses, of no pretensions whatever, in the space between it and the river, taken down also, St. James's Park might be continued right on to the water-side, forming a splendid square: of which two sides, the north and south, might be occupied by the new Admiralty, and—say the new House of Commons; while the west offered the shades and green sward of the Park, from the very midst of which would *be commanded* a complete prospect of *the river, the bridges,* St. Paul's, and the towers and steeples of a hundred churches; while on the east a flight of architectural stairs, running down to the water, would open to Waterloo-bridge and the river-side, a sort of rural view (for the space between the buildings might be laid out in an open garden), terminated by the trees of the Park. I venture to assert, "though I say it that shonld not say it," that were this square ever formed (and formed it might be, at less expense than Trafalgar-square), it would at once outshine the Place Louis Quinze, the glory of Paris, and be the pride of London. Let me request your readers, who may think me hyperbolical in this, to look how the land lies the next time they are up that way, and fancy how it might be.

I remain, yours, &c.

P. P. C. R.

August 12, 1834.

SIMPLE MODE OF EXTRACTING THE WAX FROM HONEYCOMBS.

Sir,—As the season is approaching in which cottagers and apiarians generally commence their operations on the product of their beehives, I think you will confer an obligation on many of your readers of that class, by disseminating amongst them the following most simple and efficient method of extracting the wax from the combs.

Get a bag made of coarse hempen cloth, such as safe cloth, or strong cheese cloth, either of which will do—its size to be determined by the quantity to be operated upon. Break up the combs so as to occupy as small a space as possible. Tie the bag close, and to its mouth and each corner attach weights of sufficient preponderance to sink the bag and its contents to the bottom of the water in the boiler, and retain it there. Regulate your fire so that the water shall boil steadily; the wax will speedily find its way to the surface, not unlike the fat in culinary processes, and may as easily be skimmed off into a milk pan, or some other vessel, of sufficient diameter. If some water be taken up with it it is of no consequence. Then provide a smooth blunt staff, and press and work the bag as it lies on the bottom of the boiler, until it will yield no more. If you then raise up the bag, and discharge its contents, you will find the residuum

mass of dirt, with not a particle x remaining. This no one will be ed at, if they give this very sim- ocess but a moment's considera- Indeed, the results of this method very obvious, that I can scarcely myself the same idea may not ccurred to others; but, as far as I ware, it originated entirely with f. I have practised it for at least ears past. I have kept bees forty- years; and finding the different ses in use for extracting the wax nost wasteful and troublesome, I t hit upon this expedient, when difficulty vanished in a moment. not failed to impart it to others, as my circle extends; still, I am n, it is far from being generally n.

bear me out in this assertion, I need observe, that I have read every e on bees worth notice, even down . Nutt; yet neither Mr. Nutt, nor f the older authors, have struck out ew light to direct us through this to filthy and wasteful process. It l provoke the risible muscles of readers were I to describe the vari- perose and unscientific methods now in use) to effect it, such as itting the bag (drawn out of boil- ater) to the action of a cheese press, h some (who have not that conve- e) holding the bag suspended whilst sistant compresses it with a pair of , at a risk of scalding the whole , &c. &c. On completing my first ss, the wax is immediately ready elting down into any form you like. ld any person wish to melt his test and clearest combs by them- , this he may readily do, and make cond immersion with the fouler s; but I have always done it at by melting down the skimmed and pouring it into a pan or basin ted to its quantity (having previ- wetted its inside with cold water, revent adhesion), and then cover- t up warm, that it may cool gradu- after which the inferior wax (at the m) may be cut off, melted, and d into any small receptacle, for the f the family.

I am, Sir,

Respectfully yours,

William Dummett.

ton, near Bristol,
. 13, 1834.

AN ACCOUNT OF SOME EXPERIMENTS MADE WITH MR. JOS. SAXTON'S ELECTRO-MAGNETIC MACHINE. By Jacob Green, M.D., Professor of Chemistry in Jefferson Medical College.

(From the Journal of the Franklin Institute.)

Since the publication of Mr. Saxton's electro-magnetic machine, contained in the last number of the Journal, Mr. Isaiah Lukens, with his usual ingenuity, has converted the immense artificial magnet belonging to the Philadelphia Museum into an apparatus for producing electrical currents. This magnet, it is well known, will permanently support a weight of about 134 lbs.* The length of the copper wire covered with silk, which surrounds the keeper, or armature, is 400 feet. It was expected that by thus increasing the size and magnetic power of the apparatus, that corresponding electrical effects would be produced, but, except in two or three experiments, they were nearly the same as those exhibited by a much smaller instrument in my possession.

The following experiments, made with the large apparatus in the Philadelphia Museum, will, no doubt, be interesting to those who are curious on this subject: they were made in conjunction with Mr. Titian R. Peale, to whose kindness and skill they are chiefly to be ascribed:—

The Spark.—The appearance of the spark, when the keeper revolves in mercury, is very much like the spark produced by the rotation of copper wheels in that liquid, when under the influence of an ordinary electro-magnetic current; it is perhaps brighter, and when reflected from white surfaces, strikingly resembles the coruscations of the aurora borealis. When reflected from pale blue or pale green surfaces, its colour is not at all changed. In my small machine, which is very active, the spark only appears at the moment the *cross bar* leaves the mercury; but in the large apparatus it is seen both at the *wheel* and at the cross bar.

Fusion of Metals.—When the communication between the cross bar and the wheel is made by other metals besides quicksilver, small portions of the metals appear to be fused. In order to produce these effects, a thin flat piece of the metal, about an inch broad, and rounded at the ends, must be bent in the form of an arc, and applied to the cross bar and the wheel as they revolve;

* *Description of the Magnet in the Philadelphia Museum.*—It consists of fifteen bars, weighing 53 lbs., which required, on the first trial, 310 lbs. weight to overcome the attractive force. Its permanent power is 134 lbs., and it now supports a weight of 84 lbs.—F. Peale.

the little basin of mercury being previously removed. When a strip of *lead* is used, small bluish spots of light are produced. *Zinc* occasioned a spark very much like that from the lead. When a *copper* arc was used, the light was coloured, but whether it was green, as we expected, could not be satisfactorily determined. The light from *silver* differed but little from that produced by zinc. A strip of *artificial silver* (copper and nickel) had the same effect. A piece of *tin*, or tinned iron, gave out pencils of a beautiful variegated light. With a piece of *steel*, the experiment was striking in a high degree; flashes, coruscations, and sparks, were thrown off brilliantly in every direction, not unlike the combustion of a steel wire in oxygen gas.

It is a little remarkable, that broad flat surfaces must be used in these experiments, for when blunt points form the connexions there is scarcely any light whatever produced.

Effect on Inflammable Bodies.—A jet of hydrogen gas was thrown for some time on the spark produced when the cross bar left the mercury, when that liquid was used to form the communication, but it could not be ignited. Strong ether, which is so easily inflamed by a small electrical spark, was then poured on the surface of the mercury in the little basin, and a spark was thus made to pass through it, but no combustion ensued. The power of the instrument was, however, very much impaired, as long as the ether remained on the surface of the mercury.

Decomposition of Water, &c.—All our attempts to decompose water have entirely failed. We used an instrument similar to the one described by Mr. Saxton, at p. 156, but not a bubble of gas could be observed. Besides pure water we used several saline solutions, which are better electrical conductors, but with the same results. We expected to revive the metal on one of the platinum wires when a solution of the acetate of lead filled the tubes, but we were disappointed. Supposing that points did not discharge the *fluid* as well as surfaces, we introduced into the decomposing tube strips of silver, but without effect. Perfect contact between the wires from the tube and the wheel and cross bar was particularly attended to; besides other means resorted to, a septum, or division, was made at the suggestion of Mr. Lukens, in the little basin which contained the mercury, so that the wheel revolved in one half of the mercury, and the cross bar in the other, without communicating with each other—the amalgamated wires from the tube being also in different parts of the basin; but still no visible effect was produced on the liquids in the tube.

The Shock.—When two wires are pointed at the ends, and one end of each applied to the upper and under surface of the tongue, the opposite extremities being in contact with the cross bar and wheel, a very feeble shock is felt; but when the arrangement was made in the manner described by Mr. Saxton, at p. 156, a powerful shock was experienced, passing through the tongue from one plate to the other. If, while the insulated plates in the above experiments are applied to the tongue, the upper lip be made to touch the upper plate, the muscles of the upper part of the face will then be slightly convulsed—the usual shock being at the same time produced. If one of the plates or discs be applied to the tongue, when the other disc is inserted between the upper jaw and the cheek, a convulsive motion will then be produced in the muscles of the mouth, accompanied by an acid taste, and at the same time a flash of light, as in the common experiment with the zinc and silver plates. From these experiments it is highly probable that this instrument may be advantageously used, in certain cases of disease, instead of the common electrical apparatus.

Effect on the Galvanometer and Electrometer.—With my small machine, made by Mr. Lukens on the plan described at page 155, the needle of the electro-magnetic multiplier was made to place itself at right angles to the magnetic meridian, and by a little management a rapid rotation of the needle was produced. With the common electrometer no divergency of the leaves could be effected either with the small or the large apparatus. We were so confident of success in this experiment, that it was not until all conceivable devices for the purpose had been resorted to in vain, that we gave it up as hopeless. Thus two strips of gold leaf were attached, one to each plate of the apparatus for producing shocks; then a single piece of gold, enclosed in a glass case with a solid strip of silver; these, with several other arrangements, were all ineffectual.

Effects by Induction.—We succeeded in rendering a curved bar of soft iron magnetic, by wrapping, in the usual way, a copper wire, covered with silk, many times round it, and these connecting the extremities of the wire with the cross bar and wheel. The curved bar then acted as a horse-shoe magnet, attracting by its inductive force, light ferruginous substances. The quantity of iron lifted was by no means as great as was expected. The power of magnetic induction in an electro-magnet is supposed to be in proportion to the heat produced in the wire; if that be true, it may account for its feeble

station in the above experiment. a helix of copper wire, through which ctrical current was made to circulate, ded a straight bar of soft iron, the ot being in contact with the bar, no l magnetism could be detected.

e ordinary construction of Mr. Sax-agnetic machine, the mercury in the asin forms the communication be-the cross bar and the wheel. In my pparatus, I removed the mercury, and ured to form the connexion between and the wheel, by filling the basin number of saline solutions, but no were produced. The only advanta-change in the original form of the ent which we would suggest, is when ing the sparks to remove the basin of y, and to supply its place by an arc, a circular piece of copper being then ited for the cross bar. The details, nging this little contrivance, are so as to need no further description.

are fully satisfied, that the maximum f the large machine in the Philadel-useum, has not been developed by its arrangement. It is proposed, there-alter its form, in some respects, when experiments will be made upon it.

NOTES AND NOTICES.

e informed by a correspondent (whose ad-y be obtained at our office) that "a per-got a plan matured, and in a considerable forwardness, which, if brought to bear, rnish a much less expensive and less dan-node of conveyance, on common roads, am-carriages. It consists in a combina-springs, so powerful that it will propel e with several persons at the rate of 12 hour. The whole apparatus will not ore than 500 lbs., and may be wound up n with as much ease as a horse may be or rubbed down. The invention would en brought forward long ago, if the inven-not been in such circumstances that he t afford to pay for the appendages requi-art it with style and credit."

of Burgundy.—The line of internal navi-which this magnificent undertaking has at pleted, extends from Havre de Grace to es, and is of the length of 300 leagues and . It was commenced by the states of Bur-n the year 1775, continued during the im-way of Bonaparte, and resumed in the year The whole sum expended upon it, from first mounted to 40,000,000 of francs (1,600,000*l*.). l length from St. Jean de Losne to the f La Roche, where it meets the Yonne, is metres, or 795,830 feet. It is provided with es.

al uniting the Rhine with the Rhone, and metres (or 807,085 feet) in length, has been opened; it begins at St. Sympho-ere it joins the Saone, and passes into the t a village called Kilstett, near Strasburg. lso a branch leading from Mulhausen to The expense of constructing this canal ch less than that of the canal of Burgundy, were fewer difficulties to overcome in t.

Disembarkation of the Obelisk of Luxor.—The operation of disembarking the obelisk of Luxor, from the ship Luxor, which brought it to France, commenced near Pont de la Concorde, on Friday last. The fore part of the vessel was cut away (as when the obelisk was embarked), and an inclined plane of solid wood constructed from the hold to the edge of the quay. Five enormous capstans were fixed on the quay for working the machinery of ropes, pulleys, &c., by which the block was to be removed; and they were manned by 160 artil-lery-men. When the obelisk had been shifted about 70 feet, one of the chains broke, which put an end to operations for the day. On Saturday morning the work was resumed, but the chains broke again three times, and it became necessary to add four more. At two o'clock the mighty mass was completely drawn out of the vessel and placed on the machine which was to convey it to its des-tination—*Galignani's Messenger.*

Pic-Nic Carpets.—"I must not conclude my letter without telling you of the lovely carpets we make. I have already taken my part in two of them, and am going to commence one for myself immediately. The plan is this: you buy as many squares of coarse canvass as will cover your room, and you give a square to each of your friends to fill up for you, according to her taste. One does a dog, another a bird, a third a cat, another flowers, a fifth chooses a Cashmere, or a Greek or Per-sian pattern; another person does some other. Whether animals, birds, or flowers, the ground of each square is filled in according to the fancy of the worker; so you have a square with black, another with white, blue, red, green, violet, &c. &c. &c.; in short, you have the greatest variety possible in colours and patterns. When all are done they are sewed together in a manner that the stitches are invisible, and I can assure you, that you have the most bizarre and the most beautiful carpet pos-sible."—*Parisian Correspondent of the Lady's Magazine.*

The present summer has been one of the hottest experienced for some years, both in Europe and America, the latter in particular. The New York papers state, that for three successive days the thermometer stood as high in the shade as 92. The names of upwards of 30 individuals are given who had died suddenly in consequence of drink-ing cold water, or from *coups de soleil.* All out-of-door labour was for the time entirely suspended.

Cotton Seed Oil.—At Natchez, Mississipi, there is a large steam-mill for expressing the oil from cotton seed. The seed is first hulled by passing between large cylindrical rollers, resting upon beds of the same figure, into which the rollers fit; it is then bruised by two immense wheels, which are dragged over the seed in a circular trough; these wheels do not turn on their axis as they are urged round the bed. After this process, the greasy mass is formed into cakes, and being transferred to holes adapted to receive them, the driving of a wedge into the holes by heavy stampers, expresses the oil, which is received into appropriate receptacles. The cake is now well dried, and being ground, af-fords excellent food for cattle. The whole of the machinery is driven by steam, the fire to produce which is mainly furnished by the hulls of the cot-ton-seed being kindled with coal. A suspension railway connects the establishment with the land-ing on the bank of the river.—*Franklin Journal.*

A Whinstone Bridge.—A new bridge, of a novel description, has recently been erected over the Et-trick at Fauldshope, in the Forest of Selkirkshire, at the instance of the Duke of Buccleugh. It is a single arch of 76 feet span, and forms an exact semi-ellipse, the rise being only 20 feet from the cord-line. The whole is constructed of rubble whin-stone, and it is perhaps the largest arch of this description in Great Britain.—Dumfries Courier.

Liverpool and Manchester Railway.—During the last half-year, ending the 30th of June, there has been an increase, as compared with the corresponding period of last year, of 29,255 passengers, and 7,727 tons of merchandise. The total amount of the receipts for the conveyance of passengers

was............................	£50,784	6	11
And for merchandise, coals, &c...	44.014	5	4
Total receipts	£94,798	12	3
Total expenses of all kinds......	60.092	15	11
Net profit	£34.706	16	4

A dividend of 4*l*. 10*s*. per share (for the half-year) has been declared.

The Leeds and Selby Railway is to be opened on the 22d of September next, two days before the commencement of the Hull Musical Festival. Messrs. Fenton, Murray and Co., of Leeds, and Mr. Bury, of Liverpool, are making the locomotive carriages which are to be employed on this line.

Selby and Hull are also proposed to be united by a railway. A public meeting was held at Hull on Monday last, when a provisional committee was appointed to take the necessary measures for this purpose. A report was read to the meeting from Messrs. Walker and Burges, C. E., from which it appears that a double line of railway between these towns, a distance of about 30 miles, may be completed and put into a working state for 340,000*l*. When this line is executed, all that will then be wanting to form a complete railway communication across the island, from the German Ocean to the Atlantic and Irish Seas, will be the filling up of the intermediate space between Leeds and Manchester.

Railways not injurious to Canals.—Messrs. Walker and Burges state, in their Report on the projected Hull and Selby Railway, that, notwithstanding the great and constant increase which has taken place in the traffic on the Liverpool and Manchester Railway, there has been no contemporaneous falling off in the canal business between these towns, but, on the contrary, a considerable increase.

Something Incredible.—We are glad to hear that the use of cranes is now in course of trial about the docks. Liverpool, with all its local advantages, is sadly behind other ports in those accommodations, which cheapen and expedite the transactions of trade. It will scarcely be credited by posterity, that our merchants carried on their enormous enterprises, until the middle of the 19th century, without the powerful aid of machinery upon their quays.—*Liverpool Chronicle.*

Essex, Suffolk, and Norfolk, are among the richest farming counties in England, yet, strange to say, there are few parts of the kingdom where the population has increased in so small a ratio. The population, for example, of Norfolk, even with the help of the large manufacturing town of Norwich, has not, during the last one hundred and thirty-four years, so much as doubled itself, while the population of Lancashire has been multiplied during the same period ninefold—a certain proof that its natural advantages must have been subject to some very material drawbacks. In a prospectus which is in circulation for a railway through these counties, the principal cause of this prodigious difference is represented to be the "absence of those facilities of internal communication, which the northern counties possess in such abundance, in their many navigable rivers, their far branching canals, and fast extending railways." The writer very truly observes,—"The counties of Es-*sex, Suffolk, and Norfolk,* are intersected by few *rivers, and by none of magnitude*; and there is no *general system of canal communication to compen-*
sate for the paucity of navigable rivers.
the same natural circumstances which have
the water-courses of this district in size an
ber, make the introduction of a general sy
canals wholly impracticable." "If ever
fore," he forcibly adds, "the internal co
cations of these counties are to be materi
proved—if they are ever to be placed, in
spect, on the same footing with other part
kingdom—if their natural resources are
have full justice done to them—if their m
tures are ever to thrive as they might, *it*
by the introduction of railways; there is
no other means of prosperity, or even safet
The proposed railway is to pass through R
Chelmsford, Colchester, Ipswich, and N
and terminate at Yarmouth. From the ve
nature of the country—the most level, in
the same extent in Great Britain—the high
mit level will be seven times lower t
highest summit level of the Southampton
and eight times lower than that of the
and hence the expense of executing the
not, it is supposed, exceed two thirds of t
mated cost of the Birmingham line, thoug
derably longer.

The treatise respecting which Mr. Squir
inquiry was published by Highley, of Flee
If he is still unable to procure it, we shall
to lend him our copy.

The plan for an Improvement in the
Lamp, communicated to us by J. J. H., is p
similar to one brought forward by a Mr. D
few years ago.—See page 328 of our
Number.

In a preceding part of our present Num
have inserted a letter from Mr. Badnall, an
ing that the Whiston Branch Railway, *on*
dulating plan, was on the point of being
and that a series of experiments, to determ
soundness of the undulating theory, was to b
on the 14th inst. As the letter came too
hand to enable us to make this announceme
lic before the day of trial, we caused it to
vately notified (as requested by Mr. Badnall,
Cheverton, Junius Redivivus, Kinclaven, S.
other friends, who have taken an interest
undulating railway controversy. Since th
have received a letter from Mr. Badnall,
"Liverpool, Aug. 13, 1834," in which he
"On my arrival at Liverpool, I was sorry
that our trial has been postponed for a fev
The Branch Railway will not be completed
Monday next, and we have thought it b
allow the road to be used for a short time
our day of trial, in order that the rails on t
and old lines may be as near as possible alik
gard to smoothness. I have no doubt, howev
I shall be able to furnish you with the result
experiments next week, and we can afte
fix a day for another trial, should any of yo
respondents be dissatisfied with such result
anxious to propose any other tests than those
we may agree upon."

Mr. John Marrs—Wigney—the rest corre

Communications received from S. Y.
Woodhouse—Mr. Deakin—Mr. Aris—R. 2du
Jedd.

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SECURE METHOD OF TUNNELING.

Fig. 1.

Fig. 2.

SECURE METHOD OF TUNNELING.

Sir,—It is currently reported, that, owing to the soft and crumbling nature of the earth through which the tunnel of the Birmingham railway is to pass, at the foot of Primrose-hill, many accidents will probably occur, and even lives be endangered.

With a view to obviate this evil, I would beg a small space in your valuable columns, to describe a plan which, if practicable in itself, would probably render the progress of an excavation of a like nature perfectly free from risk.

Let there be a series of cast-iron sections or shields (pointed and sharpened at one end to facilitate their penetrating the clay), of about 12 or fourteen feet long, 12 to 15 inches broad, and of moderate thickness, each section being arched or circular, as shown in fig. 2. Between the sides of the sections let there be grooves for their edges to slide in, by which means the whole may be kept compact, and the horizontal movement preserved. These detached sections and grooves may be alternately driven forward into the clay, until they are in a line with each other; for this purpose a projecting plate is made on each, to enable them to be driven by a small lever, or jack winch (the latter I should prefer). When this is done the excavators may proceed with perfect security until they come to within two feet of the end, when the shields may be driven forwards as before. The other end of the shields are supported by the brickwork upon which they rest, in conjunction with the earth at the other end (as seen in fig. 1), where they have just been driven forwards into the clay.

By using the above method several advantages seem to me to present themselves. One will be that of safety to the workmen, who feeling themselves more secure will be enabled to proceed more rapidly; another will be, that the earth will be cut level, and the settlement upon the brickwork be gradual and regular, so that if the arch be well built in the first instance, which the shields will enable them to accomplish without risk, there will be no sinking of the arch, as is the case in the tunnel of the Regent's Canal. Another will be that, from the earth not being shaken during the process of excavation, or the air admitted to act upon its surface, and also the circular figure of the incision, there will be far less pressure upon the shields (and consequently the brickwork) than were the contrary the case, and the excavation to proceed in the usual way, when the earth falls in. One difficulty will occur, but which may be removed—this is when a large stone comes in contact with one of the sections, in which case that section may be for a time left, and the others forwarded as usual, when the workmen may excavate under the one that is stopped first, without removing the earth from the others until the obstacle is removed.

Fig. 1 is merely a sectional view of a tunnel; *a* the sections and grooves as they may be used; *b* the brickwork; *c* the body of clay through which the tunnel is to pass; *d* the pointed ends of the shields, as they pass into the earth, but shown here for the sake of illustration. Fig. 2, *a* the shields, *e* the grooves.

Trusting that I have not infringed upon your patience,

I remain, Sir,

Yours respectfully,

JAS. WOODHOUSE.

Kilburn, August 9, 1834.

THE UNDULATING RAILWAY.

Sir,—As the communication from Mr. Badnall, touching the railway experiments, did not reach me till late on Monday evening, it was of course too late to take advantage of his offer; but by your note in No. 575, I perceive the experiments are postponed, and therefore I take the opportunity of saying a few words on the subject, though much occupation will not allow of sufficient time for any well-digested proposition.

After all that has been said and written, *pro* and *con*, my opinion remains the same, *i. e.* that the undulating system is inferior to the horizontal line. Perhaps there may not be available means to produce what I am about to propose, and if so, let it rest for *quantum valeat.*

If there be a correct means of ascertaining the exact amount of duty put

forth by a locomotive engine in running a given distance, on a perfect level, so as to run (say) a mile after attaining a maximum speed, let it be tried, and suppose the whole to be exactly a mile and a quarter. Then let the same engine be placed at the lowest part of an undulation which descends from and ascends to the same horizontal level. Let the steam power be then set on to work the engine up to that level, and as much more of it be used in conjunction with the power of gravity, as will enable it to descend the undulation, and place it in the level on the opposite side; the total distance run on a horizontal line, without taking the undulation into account, being exactly a mile and a quarter, as in the former case. Let the total amount of duty expended be then ascertained, and if all the circumstances in the two experiments be alike, and the amount of duty expended in the undulation be less than that on the level, then the verdict must be decidedly in favour of undulation. Mr. Badnall will perhaps object to this, that I propose to do more distance on the undulating than on the horizontal line. This is true; but his power of gravity can only be obtained through the means of extra force applied to place the engine in an unnatural position for rolling bodies, *i. e.* on a summit level.

I will suggest another experiment:—Get an engine up to its maximum speed on a horizontal line, and then measure the amount of duty required to progress it a mile. Place the same engine on the summit level above an undulation, urge it downwards by gravity alone, and when gravity ceases to operate, measure the amount of duty required to overcome the ascent, and place the engine on the same level it descended from. The total distance on the horizontal line to be an exact mile, as before. Did not want of leisure prevent me from acceding to Mr. Badnall's request of personal attendance, other impediments would intervene; but I doubt not that, if the experiments I propose are capable of trial, they will be tried with perfect fairness.

I remain, Sir, yours, &c.

JUNIUS REDIVIVUS.

August 16, 1834.

ON THE CONSTRUCTION OF A ZODIACAL MAP.

(For the Mechanics' Magazine.)

The angular positions of the heavenly bodies are expressed by co-ordinates referred to the plane, either of the ecliptic or of the equator. Ancient astronomers adopted the former, modern ones the latter. The change began about the time of Flamstead, whose catalogue of fixed stars was the first that exhibited the R. A. and Decl. from direct observation, and the Long. and Lat. by calculation. For the last half century, notwithstanding the more complex expression of the effect of precession, aberration, and nutation, when referred to the equator, astronomers have decidedly adopted it as the basis of their determinations, and within that period all the original catalogues of stars have been expressed in R. A. and Decl. only.* But down to a much more recent period, the national Ephemerides gave the planetary places in Long., Lat. and Decl. only, and when the R. A. was first inserted it was merely approximative. It being obviously proper that Ephemerides and Catalogues should be consistent, it was ordered, upon the remodelling of the "Nautical Almanac," that the geocentric places of the planets should be exhibited with the utmost accuracy in Right Ascension and Declination only.†

The construction of zodiacal maps by R. A. and Decl., necessarily follows from the present state of things. I propose to point out a simple method of doing this. The labour of previous calculation may be saved by using the printed tables, entitled "Reduction of the Ecliptic to the Equator—Declination of the Ecliptic—Angles of the Ecliptic with the Meridian."‡ In these tables, as usually given, longitude is the argument; but they can be transformed into others having Right Ascension for argument.

* The globe-makers have been slow in adopting the modern form. With the exception of Addison's 36-inch sphere, all the celestial globes now on sale are delineated by longitude and latitude.

† I trust that the editor of "White's Ephemeris" will contrive to give the planetary R. A. to *tenths* of a minute of time at least.

‡ Mayer, Tabulæ Solis; Tables de Berlin; Philosophical Magazine, vol. lvii.; Pearson's Practical Astronomy, vol. i.

In the latter shape an extract from them is here presented:—

R. A. from nearest Equinox.	Longitude from nearest Equinox.		Compl. Merid. Ecliptic Angle.		Declination of Ecliptic.	
°			°	′	°	′
0	0	0	23	28	0	0
2	2	11	23	27	0	52
4	4	22	23	24	1	44
6	6	32	23	20	2	36
8	8	43	23	13	3	28
10	10	53	23	5	4	19
12	13	53	22	55	5	10
14	15	12	22	44	6	0
16	17	22	22	30	6	50
18	19	30	22	15	7	39
20	21	39	21	58	8	27
22	23	46	21	40	9	15
24	25	53	21	20	10	1
26	28	0	20	58	10	47
28	30	6	20	35	11	32
30	32	11	20	10	12	15
32	24	16	19	44	12	58
34	36	20	19	17	13	39
36	38	23	13	48	14	19
38	40	25	18	17	14	58
40	42	27	17	46	15	36
42	44	28	17	13	16	12
44	46	28	16	39	16	47
46	48	28	16	3	17	21
48	50	27	15	27	17	54
50	52	25	14	50	18	24
52	54	22	14	11	18	54
54	56	19	13	32	19	22
56	58	15	12	52	19	48
58	60	11	12	11	20	13
60	62	6	11	29	20	37
62	64	0	10	46	20	59
64	65	54	10	3	21	20
66	67	47	9	19	21	39
68	69	40	8	35	21	56
70	71	32	7	50	22	12
72	73	24	7	4	22	27
74	75	16	6	18	22	40
76	77	7	5	32	22	51
78	78	58	4	45	23	1
80	80	49	3	58	23	10
82	82	39	3	11	23	16
84	84	30	2	23	23	22
86	86	20	1	35	23	26
88	88	10	0	48	23	28
90	90	0	0	0	23	28

Having then drawn a right line, 90° long by scale, to represent the first quadrant of the ecliptic, and parallels to it 10° north and south, divide the line into forty-five parts, according to the second column of the table, beginning at the right hand. 2. Through the points so ascertained draw meridian lines, making with perpendiculars to the ecliptic the several angles denoted in the third column. 3. Mark off on those meridians the degrees of declination, in such manner that the intersections with the ecliptic may agree with the values *indicated in the fourth* column. 4. *Lastly, through* the graduated meridians, draw curved parallels of declination, which, at the equinoctial end of the projection, will approximate to right lines. The meridians at the odd degrees of R. A. may be inserted by bisection. The projection thus made for the first three signs will serve, by reversion and inversion, for the other nine signs.

I have recently lithographed a projection of one-third of the sphere, according to the principles described in the last volume (No. 589). The diameter is 17 inches, the central scale 0·105 inch, being that of a 12-inch globe, and the meridians and parallels exhibited for every two degrees. At the foot of this is a projection of a quadrant of the zodiac, on a scale of 0·2 inch to a degree, the lines of R. A. and Decl. drawn for every degree. These projections I shall probably publish for the use of students. An impression of them has been forwarded to the editor.*

J. W. Woollgar.

Lewes, August 18, 1834.

DYNAMOMETRICAL EXPERIMENTS.

Sir,—About six weeks ago I had a dynamometer made, and I now send you an account of some experiments I have made with it:—

1st. A waggon and its load=3 tons was moved by one horse, exerting a force of 6 cwt.

2d. The same horse exerting all its force at a dead weight=12 cwt.; weight of horse=13¼ cwt.

3d. Waggon and its load=1 ton, 17 cwt., was moved by one horse exerting a force of traction=4 cwt.

4th. Experiments with boats on the Grand Junction Canal.

Boat and Load in Tons.	Traction in Cwts.	Speed in Miles per Hour.
12	4	4½
34	1½	2¼
14	2	3¾
10	1½	5
21	1½	3¾
9	¾	3
36	1½	2

I am, Sir, yours obediently,

William Andrews.

Ivinghoe, Bucks, July 1, 1834.

* Which the editor will be very glad to show to any of his readers, who may be desirous of inspecting it.—Ed. M. M.

EAM COMMUNICATION WITH INDIA.

r,—While it may be freely admitted the Messrs. Seaward have advanced strong reasons in favour of attempt- a regular communication by steam India, by the Cape of Good Hope, by no means so clear that they have lished the superiority of the old over the proposed "south-east ige," as a line for the rapid trans- ion of intelligence. It is quite a ke to suppose that either the Steam mittees in India, or the Committee e House of Commons, propose to ve *commerce* back into its ancient nels." The convenience of the Cape for mercantile purposes is fully ad- d, and the chief, and almost only, se of the new arrangement, is to de a conveyance of greater and certain rapidity for letters and de- hes. That this is a great desidera- is evident from the fact, that our n governors, as well as merchants, sometimes had to wait not less than nonths over the time of the expected l of a vessel,—a period sufficient e accomplishment of the whole dis- by the proposed "south-east pas-

e article in the Mechanics' Maga- of August 2, calls the new route n 4 to 5,000 miles shorter than that e Cape of Good Hope." This is an understating of the amount . Messrs. Seaward tells us that tual passage is about 14,000 miles; believe it will be found that the -east passage, whether by the Red r the Persian Gulf, is under 5,000, t nearly double the distance speci- ill be actually saved. No speed, , in steaming, by the old route, ake up for so great a difference as Besides, if it is so very practicable am away at ten miles an hour ghout the whole of the longer pas- what is to prevent the same being with the shorter?

e, there is the land carriage in the and this is, of course, the grand le to the new plan. I do not see, er, that it necessitates the division passage into *four* stages. By the n Gulf, for example:—one steamer proceed *from* England to Scande- *he port on the Mediterranean,— hence the letters* and passengers would be conveyed overland to the nearest port on the Euphrates,* where a second steamer would be in waiting to complete the passage down the Euphrates and the Persian Gulf to Calcutta and Bombay. Where is the necessity of a vessel exclusively for the river? Such a necessity has never, I believe, been contemplated by any but the Messrs. Seaward, and they, perhaps, would not have discovered it, had they not been hard pushed for objections to the south-east passage.

It should not be overlooked that the European half of the proposed line of steam navigation is already established. All that would be necessary to complete the chain, were the proper measures taken on the Asiatic side, would be, for our Government to order one of the Malta mail-packets to proceed on to Alexandria or Scanderoon, as the case might be. The arrangements for steaming by the old passage, of thrice the length, would have to be wholly made throughout the whole extent. No slight task, if we recollect that the only officer who has a knowledge of steam navigation by the Cape, *from experience* (Lieut. Johnson, commander of the Enterprise), considers that no less than *twenty* depôts of coals ought to be provided at different places on the route! True, Messrs. Seaward do not think so; but then Messrs. Seaward have had as little experience in steaming to India, as their friend the Dutch engineer had in making steam-engines. *He* was sanguine enough of success; and Messrs. Seaward are sanguine enough of being able to reach India in about half the time the Enterprise consumed in effecting the passage. But the Dutchman found his inexperience had deceived him. *Verbum sat.*

Allowing that Messrs. Seaward's plans would be perfectly successful, it appears that the old passage would take twenty days' more time than the new. Even if this were all the saving, it would surely still be worth while to establish the new route, if only for the conveyance of letters. It is not by any means clear, however, that the south-east passage would take up so many as fifty-two days. In

* In the article referred to, the Euphrates is spoken of as if it communicated with the Mediterranean,—if it did, there would be no need of an overland journey.

favourable circumstances there is reason to hope that it might be accomplished in less than forty.

I do not know why the Messrs. Seaward should regard the proposed new passage with an evil eye. There is room enough, and to spare, for both projects; and it is certainly rather a disgrace to us that steam navigation by the Cape has not yet been effected to any extent—that the voyage of the Enterprise should yet remain a solitary instance of the spirit of "enterprise" in that direction. Let Messrs. Seaward persevere, then; but let them not seek success by detracting from the merits—totally distinct as they are—of the "south-east passage."

There seems to be still a little misconception in your pages as to the purport of the recommendation of the Parliamentary Committee. They considered the practicability of the route by the Red Sea as *already demonstrated*, and recommended the immediate establishment of a regular line of packets on it, the expense to be divided between the Government at home and the East India Company; and the 20,000*l*. voted is to be appropriated solely to *making the experiment* of a voyage by the Persian Gulf and the Euphrates.

I remain, Sir,

Yours respectfully,

F. H.

London, August 15, 1834.

PRACTICAL REMARKS ON WORKING INCLINED PLANES.

Sir,—The plan adopted, in the Wemyss colliery, to stop the carriages on the inclined planes when the chains break, answers the purpose, no doubt, very well in *underground* situations, as observed by Mr. Landale; but the inclined planes in this district are mostly employed for sending weights down the hill-sides to the canals, tram-roads, &c., at the foot of them. The machinery made use of consists of nothing more than a horizontal wheel (some of them incline towards the planes) at the top of the plane, with *a groove round it* for the chain to run in, *and a break to* govern the speed; the *chain running* round the back of another grooved wheel at the bottom of the plane; or, instead of a large wheel at bottom, a half circle of grooved pulley wheels carry the chain round at bottom. The chains of course are endless ones. The loaded carriages invariably go down the same side (as the machinery moves invariably the same way), and the back carriages, or empty ones, return by the other side of the chain. The carriages are taken off empty at the top of the plane on one side, and put on loaded on the other side of the chain, *one at a time*, so that a regular distance between each carriage on the chain is always attended to. The same is done at the bottom, that is, when a loaded one is taken off, one loaded with back carriage, or an empty one, is put on the other side of the chain.

There are generally three or four carriages on each side of the chain, at regular distances from each other, going down and returning; and when the chain breaks, the whole of the carriages, chain and all, go down the plane in a confused heap. Nor is this all, for the chain itself being knocked about is often cracked and damaged, so that other breakages generally follow; and after repeated breakings of the chain, the iron becomes greatly impaired in tenacity. (Here I beg leave to say, that

the best way, I think, to restore the iron to its quality again, is to draw it through a fire and heat it well: by so doing, any flaw or crack in the links may be discovered.)

The only way that I have thought of as likely to stop the carriages on an inclined plane, working on the above principle, when the chains break, is this:—We hang the carriages to the inclined chain by *bridles*—chains in the form of fig. 1. A is hooked upon the endless chain; the hooks B and C are hooked on each side of the back part of the carriages. Now, if there were a toothed rail laid (see fig. 2) as near the middle of the road, on the planes, as the rollers and the traversing of the main chain would allow, I think it likely that the double of the bridles at D would catch the tooth-rail at E; and as it is necessary for every carriage to have a bridle attached to it, both going down the plane and returning, I think several of these bridles may take hold of the toothed rail, and stop the whole from going down the planes: the bridle chains may be made strong for the purpose. The only inconvenience in that would be that they would be more cumbersome to handle.

Mr. Landale's plan, fig. 4, No. 569, Mechanics' Magazine, is something on the above principle; but to catch the carriages by the bridles as above described, would not produce any alteration in our present mode of working. The only additional expense would be the laying of the toothed rail on the inclined planes.

I admit that the sudden jerk, when a bridle first catches the toothed rail, may break that bridle chain, but the jerk would be less on the next taking hold, for the double of the bridle chains would be trailing over the tooth-rail until they all took hold.

I am, your obliged servant,

THOS. DEAKIN.

Blaenavon, August 6, 1834.

A FEW MORE WORDS IN BEHALF OF MATHEMATICAL SCIENCE.

Sir,—As I find I must be absent from London for two or three weeks, I will *not have an opportunity, during that time, of continuing my* appeal in behalf of mathematical science; and as my last short article will hardly be a mouthful for your highly-gifted correspondent, Mr. Cheverton, I beg leave to give him one morsel more before I take my departure.

LEWIS FREND.

St. John's Wood, Aug. 17, 1834.

In the first place, I must correct on error in my last. In speaking of John Dollond, page 331, col. 1, line 3, instead of 1740 or 1741, I should have said 1753.

Notwithstanding the opinion expressed by Sir I. Newton on the effects of refrangibility on the refracting telescope, Euler, it appears (although a rigid disciple of the Newtonian philosophy), was not satisfied; for we find that, in 1747, he tried to prove the possibility of destroying the effects of colours on the focal image, by imitating the structure of the eye, which he considered to be the most perfect of all optical instruments.* He proposed to construct a convex lens, having its cavity filled with water, from which he expected to produce distinct vision freed from the effects of refrangibility, and also from the aberration produced by the spherical figure of the lens. He, however, did not altogether succeed —in all probability for the same cause that Gregory failed. In truth, he was not a practical optician; pure intellect was the region of all his speculations. In 1752, Mr. John Dollond communicated to the Royal Society of London, a paper endeavouring to show that the principles advanced by Euler were quite at variance with those deduced from Sir I. Newton's experiments on the refrangibility of light; although, at the same time, it was doubtful if either the one or the other of their theories were consonant with the laws of nature. On this subject the scientific world were much divided in their opinions. At last Mr. Dollond, in order to satisfy himself, had recourse to experiments, the result of which was, that he found that he was wrong himself, and that Euler was right. Being thus cured of his former preju-

* I do not know what Euler's opinion on this head might have been 10 years afterwards, when, unfortunately for himself and for science, he became totally blind.

dices, although not liking the expedient of enclosing water in the lens, he at last, after four or five years of fatiguing research, succeeded in constructing an achromatic refracting telescope, in the way mentioned in my first article. And here, Mr. Editor, I cannot help thinking that although Euler did not succeed, still the discoveries he made as to the method of destroying the errors arising from the effects of colours on the extremities of the focal image, were the means of directing Mr. Dollond in his construction of the first refracting telescope, which he produced in the year 1757. However, be that as it may, he was more fortunate than Mr. James Gregory; he lived to see, and was one of the first to congratulate Mr. Dollond on his great achievement. He was too much of a sage to indulge in any peevish reflections on this seeming triumph of Mr. Dollond. Different was the fate of Mr. James Gregory; he did not live to see a construction of his reflector, according to his own principles, although Newton with his own hands had attempted it. However, in 1724, Mr. James Short, a first-rate artist, and highly celebrated for his mathematical and astronomical attainments, succeeded in constructing a telescope according to the principles of the first inventor.

What Mr. Cheverton means when he says, that the most valuable method of determining the longitude is by means of the telescopes constructed upon the principles of Mr. Dollond, I am at a loss to guess. Does he mean that of finding the longitude at sea ?* If so, I am compelled to inform him that he knows nothing about the matter. Hadley's reflecting quadrant and sectant, as improved by Ramsden's dividing engine, must rank as one of the greatest mechanical discoveries that ever was made in aid of nautical (or, I might add, practical) astronomy. It is now universally used at sea for determining the longitude. While mentioning the names of Dollond, Short, Hadley, and Ramsden, those of Graham and Bird ought not to be forgotten; they equally distinguished themselves in their various mechanical and optical discoveries. The only charge that can be brought against them that can diminish their reputation, in Mr. Cheverton's estimation, is that they were all more or less addicted to the useless studies of geometry and astronomy. Indeed, I have heard that one of them (whose name, perhaps, it would be improper to mention) indulged himself in the sinful practice of acquiring a knowledge of the higher analysis.

I shall have yet something further to say at a future opportunity; meanwhile, I beg to subscribe myself,

Mr. Editor,

Your very obedient servant,

LEWIS FREND.

* *The writer of this article* has had considerable *practice both at sea and land*, in taking and *working lunar observations*.

INSTRUCTIONS FOR CONSTRUCTING AN ELECTRICAL PLATE MACHINE.

Sir,—In answer to the inquiries of J. L., inserted in the Mechanics' Magazine for June 7, No. 505, I beg leave to state, that any glazier will cut a glass plate circular, or nearly so; the edges may then be finished in a lathe, by cementing it on a chuck, and applying emery and water on a piece of tin-plate, in the manner the watch-glasses are finished. The hole in the centre may then be expeditiously cut while in the lathe, by cementing a small block of wood to the centre of the plate, about two inches diameter, and half an inch thick; in the centre of which turn out a hole, down to the glass, of the size required. J. L. must then get a copper ferrule, of the same size as the hole in the wood, and about one inch and a half long; half of this ferrule must be fixed on the end of a tool handle, for the convenience of holding it steady in the hole previously made in the wood on the glass. If the copper ferrule or tube is properly applied to the centre of the glass with emery and water, it will very soon cut out from the centre a piece the size of the copper tube. J. L.'s glass will be thin enough for his purpose, and of sufficient diameter to do all that he requires. He may easily fix the plate on its axis, by having a shoulder of a piece of boxwood on the spindle, and another piece to screw firmly up against the plate: this will keep it from turning when in use.

Optical glasses are *ground* with emery, of various degrees of fineness, on brass tools; the very small magnifiers are best

done in the lathe: they are polished, when brought to a fine face in grinding, by covering the tool with cloth which is moistened with water and putty powder.

I shall be most happy to give your correspondent J. L. any further information in my power. I am, Sir,

Your most obedient servant,

TUBAL CAIN.

August 3, 1834.

SUBMARINE OPERATIONS—ABSTRACT THEOREM.

"And each St. Clair, * *
* * * * *
* * * * *
But the wild winds sung
AND THE SEA-CAVES RUNG
The * * * *"

Ballad of Rosabelle—Sir Walter Scott's Lay of the Last Minstrel.

Magdalen College, Cambridge,
August 21, 1834.

Sir,—In reply to your letter I send you, copied from my papers, the rigorous enunciation of the theorem in submarine operations, the *rationale* of which I gave you in one of our late conversations when I was in London, as a witness before the Committee of the House of Commons for the Improvement of the Navigation of the Shannon and its tributaries.

Suppose a perfectly solid rock under the sea, and either a natural cavern or artificial chamber to be formed in it, with a horizontal orifice, sufficiently wide to permit a man to pass through it. I speak of a depth, not like that of the hall of Domdaniel, where the magicians, destroyed by Thalaba, had their college, and their self-suspended spherical altar, "under the roots of the ocean;" I speak of the ordinary depth at which work is done under water by a diving-bell, say twelve or thirteen fathoms.

Now, on these *data*, the following is the enunciation of my theorem as copied from my memoranda:—

"Lough O'Connell, County Clare, June, 1834.

"A person who has descended in a diving-bell to the bottom of the sea, to the level of the mouth of the orifice, and held conversation, during his descent, *with the persons above water*, may then go down into the natural or artificial chamber in the rock, and remain in it quite alone, after the bell in which he descended, and the companions who descended with him, shall have been taken out of the water altogether. While there, he may either read or write, or make drawings, or occupy himself with a musical instrument, or in any other similar manner he may choose—quite unwet, and in his ordinary costume, without any alteration whatever—by candle light, or by lamp light, burning within the chamber. He shall be suspended in the air within this submarine and subterranean chamber—to him (to take a description from Ossian) an 'airy hall'—and he shall hold conversation with a person above, utterly unsupported by land or by water, or a vessel on the water, but held, like himself, in suspension in the air.

"They may not only hold conversation, and interchange writings or drawings with each other, but they may even exchange places—or both may be together, either under the sea or above its surface, held in suspension in the air.

"Many other results immediately, *and by inevitable consequence*, follow from the application of my principle of construction, but I limit myself, for the present, to the following, and say—

"Finally, either one, or both, or three, &c., (the number of persons forms no element of the abstract mechanical principle, and I am now only speaking of an ABSTRACT PRINCIPLE)—I say that either one, or both, or three, &c., after having been either held in suspension in the cavern, or in the chamber under the sea, or standing or sitting in it, on the bare rock itself, may ascend; and after having been held in suspension for an indefinite time in the open air above, may be taken into the car of a balloon, if they wish it, and soar away in the usual manner.

"Remember, I am giving a mere abstract theory,—but unless the laws of hydrostatics and pneumatics, and the general laws of nature, have altered within the last five minutes, the opposite process will hold good too; and they may be transferred from the car of a balloon to the point of suspension in the air, and may then descend into the submarine

chamber in the rock, the perfect solidity of which, is an element I have assumed."

These things to some may appear paradoxical, but to me they are as familiar as the airs of my native land, what Lord Byron calls "the heart-home lays of green Erin." From the hour when I invented my own diving-bell, I have had a kind of amphibious intellectual existence—my imagination becoming a kind of dream, like Clarence's in Shakspeare; working, as it were, by an irresistible impulse, under the ocean. "But still the envious flood kept in my soul," and in that intellectual working, running eternally in dreamy visions through the mazes of novel combinations, generated from my new principle.

Let it be remembered by any one who may be inclined to be incredulous, when I now give the enunciation of a novel theorem in subaqueous science, that I am the very first who, since the creation of the world, stood above water, holding communication with those around me; and at the same time conversed with a man under the water, who was standing not only unwet on the bottom, but had at the same time a light burning in his hand. I do not say at the bottom, but on the very bottom itself, of the water.

And now, having given so much of pure scientific abstraction, permit me to call your attention to something very practical, and for which I may perhaps obtain for myself a highly exalted character among the fishermen of the world.

As fish are attracted by light burning under water, would it not be well worth while to institute a methodical experimental investigation, in order to ascertain to what extent this principle may be made usefully available in great fisheries?

Why should I despair of obtaining sublime and portentous piscatory glory for this suggestion, when I remember the character of Earl Reginald, in the *Castle Spectre*, given by a fisherman,—

"Ah! Earl Reginald was a true nobleman. *He had all the cardinal virtues*—so generous, so kind to the poor, *and so fond of fish!*"

I have the honour to be, Sir,

Truly and sincerely yours,

THOMAS STEELE,

An Associate Member of the London Institution of Civil Engineers.

EXPLANATION OF AN ALLEGED DISCREPANCY IN THE NORTHAMPTON LIFE TABLES.

Sir,—In your Magazine for March last (No. 551), "A Country Teacher" requested an explanation of what he considers a paradox, viz., the circumstance that while the Northampton Tables shew an annuity on a life aged 13 to be worth about a year and a half's purchase more than an annuity on a life aged 2, the expectation of life at these ages is exactly the same. I have seen no explanation of this circumstance in any of your subsequent numbers, and I now, therefore, send you the following observations:—

The present value of an annuity on a single life is found by multiplying the sum payable for each year from the given age to the oldest in the table, by the probability of the life surviving each age, and then discounting these products back to the present age of the annuitant, on the principle of compound interest. A greater amount of discount is in this way deducted, in ascertaining the present value of an annuity on any given life, than on one older; and it therefore follows, where, as in the case alluded to by your correspondent, the expectation of life is the same at the ages 2 and 13, that an annuity on the latter must be of greater value than an annuity on the former. That this must be true in all such cases may be likewise demonstrated generally as follows:—

Let Y = present value of annuity on the younger life.
O = present value of annuity on the older life.

And let the number of persons living at the age of the younger life, according to *any given table of observations*, and at 1, 2, 3, &c., years older be denoted respectively by a, b, c, d, &c.; and the corresponding numbers for the older life by f, g, h,

, &c. Moreover, let the *amount* of 1*l.* in the year, according to the given rate of interest, be denoted by R.

Then the expectation of the younger life is $\frac{1}{a}(b+c+d+\&c.)$ and of the older, $\frac{1}{f}(g+h+i+\&c.)$. And by hypotheses $\frac{1}{a}(b+c+d+\&c.)=\frac{1}{f}(g+h+i+\&c.)$; from which there may be deduced $\frac{a}{f}=\frac{b+c+d+\&c.}{g+h+i+\&c.}$

Again, by the well-known formula for expressing the value of an annuity on a single life:

$$Y=\frac{1}{a}\left(\frac{b}{R}+\frac{c}{R^2}+\frac{d}{R^3}+\&c.\right)$$

$$O=\frac{1}{f}\left(\frac{g}{R}+\frac{h}{R^2}+\frac{i}{R^3}+\&c.\right)$$

Dividing the second by the first,

$$\frac{O}{Y}=\frac{a}{f}\left(\frac{g}{b}+\frac{h}{c}+\frac{i}{d}+\&c.\right)$$ which, on substituting for $\frac{a}{f}$, its value as above becomes

$$\frac{O}{Y}=\frac{b+c+d+\&c.}{g+h+i+\&c.}\left(\frac{g}{b}+\frac{h}{c}+\frac{i}{d}+\&c.\right)$$

$$=\frac{g+h+i+\&c.}{g+h+i+\&c.}+\frac{g}{b}\left(\frac{c+d+e+\&c.}{g+h+i+\&c.}\right)+\frac{h}{c}\left(\frac{b+d+e+\&c.}{g+h+i+\&c.}\right)+\&c.$$

and therefore $O=Y+Y\left\{\frac{g}{b}\left(\frac{c+d+e+\&c.}{g+h+i+\&c.}\right)+\frac{h}{c}\left(\frac{b+d+e+\&c.}{g+h+i+\&c.}\right)+\&c.\right\}$

The annnity on the older life is thus greater than that on the younger life by the quantity

$$Y\left\{\frac{g}{b}\left(\frac{c+d+e+\&c.}{g+h+i+\&c.}\right)+\frac{h}{c}\left(\frac{b+d+e+\&c.}{g+h+i+\&c.}\right)+\&c.\right\}$$

The apparent inconsistency which excited the attention of your correspondent will be found to be not peculiar to the Northampton Tables; in the Carlisle Tables it occurs at the ages of 2 and 12; and indeed a similar difference will be found in all those tables which exhibit an improvement in the expectation of life after surviving the diseases incident to childhood. I am, Sir,

Your most obedient servant,

W.

Edinburgh, August 15, 1834.

MR. JOHN MURRAY'S EXPERIMENTS ON FLAME, &c.

Sir,—My communication is made with reluctance, as it refers to claims of priority, in cases, the subject of controversy. A copy of my pamphlet, on "Flame and Safety Lamps," was duly sent you, and in that publication I clearly, and successfully (as I think), vindicated my equal right, if not *prior* claim to the fact, that flame is to be *simply considered* as a mere film or *luminous bubble*—a discovery exclusively assigned to Sym, by Thomson, Children, and others. My paper appeared in the "Philosophical Magazine," before Mr. Sym's was announced in the "Annals of Philosophy;" and, at any rate, our methods of proving the fact were different.

As to Mr. Rutter's affair, I can perceive only the application of the principles of Morey's "tar and water burner." As the basis of all this you will find an

experiment of mine, made in the Surrey Institution, in 1818, described in Newton's "Journal of Science and Art." This experiment gave promise that the time would come when *water* would be used as an article of fuel, and was distinctly so stated there. It was even thus applied in a furnace on my suggestion, and several years after Evans secured its application by a patent.

Mr. Witty has admitted, in a former communication made elsewhere, his obligation to me, as well as Davy, for the basis of his late invention. I differ, *toto cœlo*, from the opinions which have been advanced explanatory of the phenomena of Davy's safety lamp. The article on flame and the flameless lamp, in the last edition I have seen of Ure's "Nicholson's Dictionary," and the treatise on chemistry in the "Library of Useful Knowledge," appear to me a complete tissue of error, unwarranted by any experiment whatever. My opinions and experiments are before the public, and to it I appeal as the umpire.

Many years ago I proposed to the secretary of the Society of Arts, a method of recovering the bodies of the drowned from submersion at considerable depths, which consisted in the inflation of a membranous bag (or one rendered air and water tight by Macintosh's process), by means of a condenser attached to an extended flexible tube connected with it. I see by a model, now in the "Gallery of Practical Science," Adelaide-street, that the same principle, precisely, is suggested as applicable to the purpose of raising sunken ships.

Allow me to add, that I have left there my shipwreck arrow, with its latest improvements, for public inspection.

I remain, yours, &c.

J. Murray.

August 18, 1834.

Mr. Murray will perceive, on referring to our last number, that before the receipt of his present communication we had spontaneously done him that justice which he now requires at our hands. We should have done so at the time his pamphlet on "Flame and Safety Lamps" was first sent us, but that it happened unfortunately to get mislaid before we had leisure to read it, and has been only perused by us very recently. To place Mr. Murray's claims of priority, in their full extent, before our readers, we subjoin a further extract from his pamphlet.—Ed. M. M.

"*It is further inferred* (by Sir Humphrey Davy) *that 'the flame of* combustible bodies may, in all cases, be considered as the combustion of an *explosive mixture* of inflammable gas or vapour with air. It cannot be regarded as a mere combustion at the surface of contact of the inflammable matter. This fact is proved by holding a taper, or a piece of burning phosphorus, within a *large flame* made by the combustion of alcohol. The flame of the taper or of the phosphorus will be in the centre of the other flame, proving that there *is oxygen even in its interior part!*' On this last position (though founded altogether in error), it may here be remarked, that Lord Bacon had entertained an opinion on the constitution of flame precisely similar to that propounded by Davy, though he afterwards, in his 'Sylva Sylvarum,' refers to an experiment fatal to his previous conclusions, namely, that a transverse slip of wood is only charred at the exterior edge of the flame. Sir Humphrey Davy's error consisted in using a 'large flame,' where the phenomena are altogether equivocal and fallacious; because in such a case the flame becomes ragged, diffuse, and, among its breaks and chasms, atmospheric air finds a ready entrance. I view flame in an aspect altogether different. *It is not solid.* In texture it is a film—a luminous bubble inflated with inflammable vapour. This view of it was first advocated by myself, contemporaneously with Mr. G. O. Sym. My remarks appeared in the Philosophical Magazine, and Mr. Sym's in the Annals of Philosophy; my results were obtained with a plate of glass, and Mr. Sym's with wire gauze. If there was any priority in the case, that priority was in my favour, since my view of the structure of flame was in the possession of the public on the last day of the month (when the Philosophical Magazine was published), while Mr. Sym's appeared in the Annals of Philosophy on the first of the succeeding month. The question is of little consequence—only let fairness be placed before favouritism,*—the merit in the case, therefore, to say the least of it, is a divided one."

FRENCH AERIAL SHIP.

We extract the following notice from the *Morning Chronicle* of the 14th inst.:

"An Aerial Ship.—There is now exhibiting on the premises of the Aeronautical Society, Paris, in the Champs Elysées, what might not unaptly be termed a monster balloon. This novel conveyance consists of a balloon of 134 feet long, 34 feet high, and about 25 feet wide. It is in the form of the air-bladder of a fish, rather wide in the middle, whilst the ends are in the form of pointed cones. A balloon in this shape will meet with six times less resistance than one in a round form; and that which we are now describing is calculated to raise a weight of 6,500lbs. The car, which is made of wicker-work, painted tri-colour, is 66 feet long and very narrow, with seats (also made of wicker-work) across it at regular distances; thirty persons could be accommodated in the car, which is fixed *immediately under* the balloon, contrariwise to the plan hitherto followed, which was to suspend the car at some distance below the balloon,

* "Thus Mr. Children, in his work 'on the Blowpipe,' assigns the discovery exclusively to Mr. Sym, without the slightest allusion to my name, and Dr. Thomson as incessantly harps on the same string. My remarks amounted to these: The cone of flame may be considered a film; by pressing the apex with a plate of glass, we get an insight into its interior, while transverse sections may also be obtained; by allowing alcohol to burn on a piece of glass, slightly concave, we ascertain the form of the base and diameter of the film of flame."

movements of which it was entirely subser- without the possibility of giving it any im- The material of which the balloon is made ared in such a way as to preserve the gas een days. There is a rudder at each end of ; and at each side thereof there are two , to which are attached paddles made of ed canvass in light iron frames; these s are so contrived as occasionally to present urface to the air, and occasionally a cutting and they are set in rotary motion by means ndle. The following is the manner in which w aeronauts intend to cause their balloon to or descend, without throwing out ballast or ling the gas. In 1787, Baron Scott, and M. er, of the Academy of Sciences, observed, e air-bladder in the interior of the body of possessed the property of permitting them ge to the bottom, or rise to the surface of ter, according to whether the said bladder ompressed or dilated. In imitation of this nena, a small balloon is introduced, under ncipal one, whereby, according to the quan- exterior air which is introduced therein, a nce of thirty pounds weight of air, more , will be made in the weight opposed to the alloon. This will place at the disposal of onauts a powerful means of elevating their ship at will, to the current of air they may cessary for their purposes. They also have nged their paddles, as to enable them to e the movements of birds, which do not fly irect line against the wind, but tack, as it in the air, by rising and descending in in- directions. According to this system, the ship will tack, by inclined movements, alter- up and down, as marine ships tack horizon- rom right to left, &c. Besides the means of the desired direction to their balloon, it appear that the aeronauts have another me- f which they preserve the secret; but from ranspired in conversation, we imagine it onsist of a sort of bellows of their own in- n, whereby currents of air may be created, ficient rapidity to form *points d'appui* for paddle and each rudder. The means of ng this aerial ship, then, are, in a few as follows:—The aeronauts would seek for nt of air favourable to convey them in the -for direction. If they should succeed in ey might travel at an average rate of 10 or 12 s an hour, and often from 35 to 40 leagues an If they should find themselves between two in different directions, they would advance rate of from two to five leagues an hour, or ould remain stationary (lay to) waiting for a able wind; in the third place, if they should ter a foul wind, they would tack, by de- g curved lines up and down, like birds that inst the wind. The aeronauts will of course vided with a compass, thermometer, &c.; they lso invented an apparatus to serve the pur- f a ship's log-line, which will ascertain the l and horizontal velocity of the balloon. will likewise take with them one of Sir Hum- Davy's safety lamps and a phosphoric lan- which, without running the risk of setting the balloon, will shed a sufficient light to the party to read and write, if overtaken ght, and see the compass. The principal tor of this gigantic undertaking is M. Len- formerly a superior officer in the French and who acted a conspicuous part in politics the two first years after the revolution of He was to ascend in the balloon on the 15th gust (Friday last) from the Champ de Mars, panied by seventeen persons, among whom e Madame Lennox and another lady. The turous party seem very sanguine as to their s, and say they could reach London in six or hours, with a *fair wind*. A number of expe- riments have been made within the last two years, and all appears to be most systematically arranged; so much so, that the second in command (M. Lennox being captain) says, that it was well understood that whoever quitted his post without permission, was *to have his brains blown out without ceremony!* Whatever may be the result of the experiment, one cannot help feeling respect for those courageous individuals who are about to run such risks, in order to decide a scientific question. It is reported that the aerial ship is to proceed to London, but we could not gain any positive information as to this;—much would depend on the result of the experiment of the 15th inst."

THE FINALE!

(From the Globe of Wednesday last.)

"The ship was to have ascended on the 15th instant, from the Champ de Mars at Paris. Various circumstances caused the experiment to be delayed until the 17th. At about nine in the morning the gigantic balloon was removed from the place where it had been exhibited to the Champ de Mars; and from that hour the whole population of the capital was in movement. Near to the spot where the balloon-ship was prepared, an experiment had lately been made of a rail-road, or *chemin de fer*, but this did not excite the curiosity of the gay Parisians by any means to an equal degree as did the hardy attempt of the eighteen navigators who were about to go on a voyage for the discovery of a *chemin dans les airs!* Thus the inhabitants proceeded *en masse* to that same Champ de Mars, where so many waxen wings have been melted—so many airy projects exploded!

"As noon approached, the reserved seats began to fill, and hundreds of horsemen, private equipages, cabriolets, carts, in short, every possible description of vehicle, flanked by countless thousands of pedestrians, were seen converging from every quarter of the city towards the point of attraction, amidst clouds of dust, and under a sun worthy the meridian of Madras. As the immense masses of curious individuals, however, approached the scene of action, various indications that something had gone wrong presented themselves in the shape of returning provision-carts, freighted with uneaten cargoes, itinerant piemen with long faces, &c. &c. &c.—and it was speedily ascertained that at about half-past twelve the balloon, which had been completely inflated, and was floating at a certain height, to which it was confined by cords, and at the moment when it was being drawn down, in order that the aeronauts might embark in the car, suddenly turned topsy-turvy, and burst with a loud explosion! The crowd at first gave a cry of horror; but quickly recovering, they rushed upon the falling balloon, instantly tore it in pieces and carried it off in portions, which were exhibited and sold for a few *sols* the morsel, in every part of Paris, in the course of the afternoon.

"This outrage must considerably adjourn the period at which the projectors can renew their attempt, which, however, they declare it to be their intention to do with the least possible loss of time. The car luckily escaped from the hands of the Goths who destroyed the balloon. It is said that some slight fissures had been observed in the tissue on the evening before the balloon was to have ascended. Whatever may have been the cause of the accident, it is very fortunate that it took place before the voyagers had taken their departure. The form of the balloon has been objected to by scientific men, and the slender tissue of which it was made, as well as the dark colour of the India-rubber varnish with which it was covered."

RECENT AMERICAN PATENTS.

(Selected from the Franklin Journal for July.)

STEAM MACHINERY—*John Lockwood, State of New York.*—The patentee states that he is a member of the Society of Shakers; a society existing without the marrying, or being given in marriage, of those who compose it. Now, as they do not beget sons and daughters, the continuance of their society depends upon the adoption into it of the children of others; and were we judge by the specimen before us, the same system prevails in their mechanical contrivances. Many become members "after their passions have forsaken them," but few, however, do so at an age so advanced as that of the apparatus which forms the subject of the patent before us, or the wandering Jew himself might appear among them as a stripling. This invention is no other than a steam-engine, such as was put into operation by Hero of Greece. The steam is to be admitted through a hollow shaft, and is to pass off through two openings in arms, extending at right angles from the shaft, or rather through two openings in the periphery of a wheel placed upon the shaft. A sliding piece, fixed by a screw, is to be adapted to each of these openings, for the purpose of regulating the size of the aperture.

The Shakers deserve all praise for the neatness of their establishments, and the substantial excellence of the articles which they manufacture, and, undoubtedly, they may be able to make some contributions of a novel character to the useful arts; but we are not prepared to see the steam-engine improved by any one who is not well acquainted with its history, and with its operation in the most perfect forms which have been given to it; and this knowledge, we apprehend, is not likely to be acquired in the libraries of the society to which the patentee belongs, or from the limited intercourse between its members and the busy world. At all events, the specimen before us is one of an "advance, three steps backward."

BUTT HINGES FOR TABLES—*Humphrey Treadwell, State of New York.*—This is not properly a butt, but a table-joint hinge; it is intended as a substitute for the rule joint of dining, breakfast, and other tables, and is so made as to extend along the whole length of the leaf, and to show a quarter round of metal instead of wood. Its form may be readily conceived by supposing the half of a butt hinge to have the wire tube extended from end to end, without being divided into separate knuckles, and that there were as many of these half hinges as would extend along the whole joint; the leaf and bed of the table are then to be rebated and hollowed so as to receive the strap of the hinge, and one half of the barrel, or tube; when this has been properly done, on screwing the half hinges alternately on the bed and the leaf, so as to form close joints, this part of the work will be finished, and the leaf, when down, will show a small, continuous, quarter round of metal. It is proposed to make these hinges of sheet brass, by bending the separate pieces over a wire, in which case the strap part will be double; and this, probably, will be the best way of forming them; the patentee, however, does not confine himself to this method, but claims the general construction of such hinges, whether made of cast or of sheet metal. We think the plan a good one, as the appearance of the joint will be neat, whilst its strength will be much greater than when made in the old way. It will be somewhat, but probably not much more costly.

IMPROVED FRICTION ROLLERS — *Benj. Stancliff, Philadelphia.*—The friction rollers here patented are intended as an improvement upon those of Garnett, and it is proposed to apply them to the axles of carriages and of cars for rail-roads, as well as to many other kinds of machinery. It is observed that the friction rollers, as heretofore employed, have been applied to the axis only, whilst in carriages, cars, &c., there is frequently a great lateral thrust, and consequently a very considerable friction upon the shoulders, which has never been provided for; the patentee, therefore, places friction wheels bearing on their shoulders, in addition to the rollers acting on the sides, of the axle. The claim is to the "application of friction rollers with their axes at right angles to each other, so as to cause them to bear laterally, as well as directly upon the axles and boxes of machinery, upon the principle herein set forth, whether they are constructed in the manner described, or in any other involving the same principle." There may be cases, but they are very few, in which such rollers may be of advantage: we have several times had occasion to remark, that wherever there is any jolting in the motion of machinery, Garnett's rollers have, after a little wear, been found worse than useless; there is nothing in the plan before us to lessen this objection, and as the end rollers must have an extremely narrow bearing, they will, in such cases, fail before the others. We deem them specially inapplicable to cars and carriages.

IMPROVED MODE OF SUPPLYING STEAM-BOILERS WITH WATER—*William W. Van Loan, New York.*—The apparatus here patented is intended to keep the water in a

boiler uniformly at the proper height, and to afford the means of ascertaining that it is so. The apparatus described by this patentee is arranged with considerable skill, and looks, in the drawing, as though it would answer the intended purpose; where, however, there is an array of valves, pistons, stop-cocks, &c., to be acted on under the influence of high-pressure steam, things do not go on so quietly and uniformly as might be desired; contraction and expansion, adhesion, the introduction of air, the insinuation of steam where it was not designed to go, the destruction of packing, the defect of lubrification, and the many other ills which such a machine is heir to, defeat the most exact calculations, and the most ingeniously arranged contrivances. Under these circumstances, therefore, we are never safe in pronouncing favourably of the practical operations of an untried project; nor, indeed, will those who are well-informed upon the subject of mechanics, be very ready to do so in machines of much less complexity than the steam-engine. The general principle upon which the present patentee has proceeded is the same upon which several other contrivances for a like purpose have been dependent, but the present is sufficiently novel in the arrangement of its parts, not to interfere with them; this principle is the equality of the pressure exerted by the steam in the upper, and by the water in the lower, part of the boiler, in consequence of which, when water in any vessel is subjected to the pressure of both, it will flow therefrom as it would if not subjected to the action of either. One of the instruments proposed to be used is so simple that its action will be readily understood. It is merely a large tube, opening into the boiler just at the water line, and furnished with two stop-cocks, placed at such a distance from each other as to allow of a proper supply of water for a single stroke of the engine to be contained between them. The keys of these cocks are connected by a rod, so that when one is closed the other is open. When the outer cock is opened, water may flow into it from a reservoir; and when it is closed, and the other opened, this water may flow from the tube into the boiler.

Swift Tanning Process—*Thomas G. Peachy, Williamsburg.*—This patentee claims to have invented an improved mode of procedure in the process of tanning hides and skins, by which the time required for that operation is abridged, and the apparatus employed much simplified. The following is said to be a full and exact description of his mode of procedure:—"I form the skins into bags by sewing their edges together, leaving an opening for the introduction of the tanning liquor, which opening is supplied with a nosle, tube, or other contrivance, having in it a stop-cock, or valve, and capable of being attached by screwing, or otherwise, to a forcing pump, by means of which the tanning liquid may be injected into the bag, so as to exert any degree of pressure that it is capable of bearing. The liquid thus forced in will ooze through the skin, or hide, to be tanned, the spent liquid exaporating or dropping from the outside thereof, whilst a new and saturated portion is constantly supplied from the inside, until the process is finished, which in hides or skins of moderate thickness, may be effected in from twenty-four to forty-eight hours.

"Instead of making the skins into bags in the way described, frames may be prepared between which the edges of two skins may be pressed and held firmly together, and the tanning liquor may be forced between them in the manner before described, or the skins may be connected together in any other way that will answer the same end. When the skins of animals are taken off, as they may be, without opening them in the usual way, they may then be made into bags with the utmost facility, and much trouble be thereby saved.

"A single forcing pump will answer for any number of skins, as by means of the nosle, or tube, they may be attached and removed at pleasure, and the pressure be thus renewed, whenever it becomes necessary.

"I am aware that skins have been made into bags, and confined between frames, in the manner herein described, and that they have been filled and distended by hydrostatic pressure, by means of long tubes, so as to produce effects in some respects analogous to those obtained by me. I do not, therefore, claim to be the inventor of the application of tanning liquor to the inside of bags formed of one or more skins, this having been heretofore done; all that I claim as my improvement being the employment of a forcing pump instead of hydrostatic pressure made by means of a column of the tanning liquid."

NOTES AND NOTICES.

The mean heat of the past month at 3 o'clock P. M. was 71.9; the greatest heat at noon of the 17th inst., when the thermometer rose to 86.7—being only about 4° less than the heat which proved lately so fatal in America.—W. L.

There are about 400,000 books annually imported into England from France, being one volume for every fifty-six inhabitants; while France only receives from England 80,000 volumes, or one for every four hundred and eight inhabitants.

Hydrophobia.—The *Globe* has published a letter from Mr. J. Murray, in which he strenuously advocates the employment of chlorine as a means of both curing and preventing this dreadful malady. "I speak advisedly," he says. "This gas unhinges and renders altogether inert from decomposition the most virulent mineral, vegetable and animal poisons—as arsenicated hydrogen, hydrocyanic acid, &c., and it is more than probable that it would be proved equally efficient here. I applied strong nitro-muriatic acid (which evolves chlorine) to the wound of a man bitten by a mad dog; two years have since elapsed, and he has had no symptom of the disease. I also submitted a dog under the full virulence of rabies to an atmosphere of chlorine, and it was perfectly recovered. These cases surely speak volumes; and why medical practitioners should refuse to adopt this simple remedy, founded on such rational grounds, and with the full prospect of success, I cannot imagine; a predetermined scepticism, founded on an assumption that the question is hopeless, will not avail in the estimation of sober and reflecting judgment. A few months only have elapsed since the old routine was applied in a case which occurred at Leeds, which has been uselessly employed, and with little variation, since the days of Hippocrates and Galen, not only without any alleviation of the symptoms of disease, but even without a shade of relief from suffering to the individual. Surely this is irrational and unwarrantable; and if experiment grounded on legitimate principles be in any case admissible, it is especially so here. Many physicians have given to me in person their willing assent to my views, as the most rational of any they have met with: and I may assert, without fear of contradiction, that I have paid as much specific attention to this subject as any person now living. As a preventive, I confess I have little faith in excision, even when skilfully performed, certainly none if not immediately effected. Being quite convinced that this virus, like other animal poisons, may be safely taken into the stomach, I should not have the slightest hesitation in sucking the wound, had I the misfortune to be bitten by a mad dog; for, be it remembered, there is no time to be lost. A ligature above, and the cupping-glass to the part, are not only advisable but essential, and should be followed by the repeated application of a sponge saturated with strong nitro-muriatic acid, or chlorine. When the disease is manifested I consider the entire system affected, and therefore infer that no merely local remedy will do. The patient then should breathe an atmosphere of chlorine, that is, atmospheric air impregnated with it—as well as have the surface of the body exposed to its influence. With the application of these remedies I have no doubt of the happiest result."

Jacquard, the inventor of the silk-weaving machine which bears his name, died recently at Paris. For the last century Lyons produced but plain silks, a kind in which Switzerland and England can successfully compete with and undersell the French. But Jacquard's invention enabled Lyons to preserve the superiority in figured silks. "If Lyons," says a French journal, "has 32,000 looms, and if each loom does a third more than it did 40 years ago—if Lyons preserves its superiority, and extends its trade, despite of Zurich and its new silk fabrics, despite of Crevelt—of Elberfeld—of Austria's doubling its silk manufactures—despite of Saxony and Russia, and of the 40,000 looms of England, she owes all this to Jacquard." Jacquard, notwithstanding, died poor, at the advanced age of 82 years.

India Rubber Carpets.—Having some Indiar rubber varnish left, which was prepared for anothes purpose, the thought occurred to me of trying it a a covering to a carpet, after the following manner. —A piece of canvass was stretched and covered with a thin coat of glue (corn meal size will probably answer best); over this was laid a sheet of brown paper, or newspaper, and another coat of glue added, over which was laid a pattern of house papering, with rich figures. After the body of the carpet was thus prepared, a very thin touch of glue was carried over the face of the papers, to prevent the India-rubber from tarnishing the beautiful colours of the paper. After this was dried, one or two coats (as may be desired) of India-rubber varnish were applied, which, when dried, formed a surface as polished glass, through which the variegated colours of the paper appeared with undiminished, if not with increased, lustre. This carpet is quite durable, and is impenetrable to water, or grease of any description. When soiled, it may be washed like a piece of smooth marble or wood. If gold or silver form the last coat, instead of papering, and the varnish is then applied, nothing can exceed the splendid richness of the carpet, which gives the floor the appearance of being burnished with gold or silver. A neat carpet on this plan will cost, when made of good papering, about 37 cents a yard. When covered with gold or silver leaf, the cost will be about 100 or 150 cents a yard. —*Correspondent of the Guernsey Star.*

Crucible Furnace for Fusion.—Persons who wish to melt or assay steel are not aware how easy it is to obtain a melted mass of one or two ounces, in the space of twenty minutes, without the least difficulty, by means of the following arrangement. Make a hole in the bottom of a Hessian crucible holding two or three quarts,—put inside of this crucible the cover of a smaller crucible, so that it may rest at about three-fourths of the depth. Make, with a file, several notches around this cover to admit the air freely, having the knob of the cover uppermost. On this knob place a little crucible containing the metal, which must be covered, —put some lighted charcoal around it, and fill up with coke, so as to entirely cover the interior crucible. Connect this apparatus with a blacksmith's, or other, bellows, and keep up a constant blast, supplying the waste coal as it is consumed,—in the course of the time mentioned, the steel will be melted. Other metals, even some that are reputed infusible, will yield in like manner. This simple and cheap apparatus abridges time and labour surprisingly, and effects what with the common and costly furnaces would be impossible.—*Jour. de Con. Usuelles.*

Mr. Hancock commenced on Monday last running two steam-carriages regularly between the City and Paddington, and they have been plying throughout the week with uninterrupted success.

One of Mr. Russell's steam-carriages between Glasgow and Paisley, having been overset by the breaking of a wheel, the boiler burst, and five persons were killed. The Court of Session has, in consequence of this, interdicted the whole set of carriages from running—for the present at least. A fine specimen this of Caledonian wisdom! Why do they not also clear the Clyde of the whole of its steamers, since certain it is, that steam-boats have met with accidents as well as steam-carriages, and are as likely to meet with them again? It is impossible so absurd an interdict can stand.

Communications received from An Ex-Committee Man—Mr. Aldersey—Gravidus—Mr. Williams—S. S.

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TWIN STEAM-BOAT.

Fig. 1.

Fig. 2.

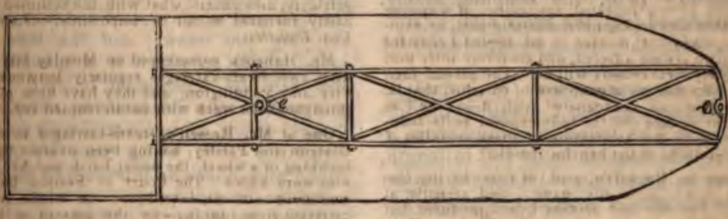


Fig. 3.

TWIN STEAM-BOAT.

Sir,—Not observing, in your useful Magazine, any observations from any of your more able correspondents, on the subject of the American steam-raft, since your publication No. 550, for Feb. 22, I beg to submit, for the consideration of those who are more particularly interested in the nautical improvements now making such rapid progress, a plan for a twin-boat, or double-bodied vessel, which, I think, for economy in building and fitting up, and rapidity in sailing, will be found very far to excel any single-bodied vessel of the same, or double the tonnage. I would first premise, that the principle of the steam-raft appears to be precisely that of the double canoe, of which a minute account has been given by so many of our voyagers.

Fig. 1 shows the twin-boat without the deck; A is the water-way, eight feet over; B B the chambers or compartments; C C the bow and stern tillers, with the connecting bars; and D D the side of the vessel above load water line.

Fig. 2 shows the keels of the vessel, bolted together and braced with a coupling frame. The connecting bar at the bow is fixed to the lower part about a foot above the keel; *e e* are the eyes, fore and aft, for the lower pintles of the rudders.

Fig. 3 is a longitudinal section of the whole vessel, showing the deck, the water-way (*a a*), the coupling frame, breast-board (*c c*), the keels and the rudders, with the ties and screw-bolts for fixing and hanging them.

The proportions may be varied as thought proper; but I consider the following will be found as advantageous as any:—The boats to be 60 feet in length, 6 feet in breadth, and 6 feet in depth; to be of iron of sufficient strength, but to be by no means overburdened with weight; to be built on a keel, and flat at the bottom, with the lower edges rounded; the sides to be upright, and in length quite straight and parallel to each other, with square sterns; the bows to be formed as in the drawing, figs. 1 and 2, and the boats to be placed parallel to each other, with an opening or water-way between them of 8 feet; the paddle-wheel to be not less than 16 feet in diameter, and to make 45 revolutions a minute; the paddle-wheel to be placed at the stern, and to extend to the external sides of the boats, leaving on the water-wheel shaft sufficient room for the cranks to drive it, which will give room for the paddle or float to be 18 feet in length, and 20 inches or 2 feet in depth. The boats and water-way will give a deck of 20 feet over. The wheel making 45 revolutions a minute, will give a velocity to the vessel of 24 miles an hour in still water, and not less than 4 or 5 miles an hour more when going with the tide. The form of a twin-boat appears best calculated for avoiding every impediment to speed, and furnishing every facility for promoting it. The keels are to be firmly bolted together with a coupling frame, by means of flat iron bows of sufficient strength, and screwed on the outside, as shown in fig. 2. A strong coupling frame must be placed between the boats, about a foot above the load water line, similar in form to that united to the keel, and must be very strong, as shown in fig. 3. This frame must be firmly fixed and bolted quite through, and screwed on to the external sides of the boats. It will be necessary to place what may be termed a breast-board, to be firmly fixed upon the angle, as near the bows as convenience will admit (as shown in the drawing, fig. 3). This board must be fixed in the water-course to the sides of the boats, the lower end to the coupling frame, and the upper end to the beams of the deck. This will have the effect, in a head sea, of raising the bow end of the vessel so as to avoid shipping the wave; and the less the acute angle on which it is placed, the less will the concussion be felt. The gunwale of the boats is to carry the beams, which, when covered with planks, forms the deck, which may be railed round and otherwise fitted up, as may be suitable for the purpose intended. A sufficient number of the beams should be firmly bolted to the sides of the coupling frame, in order that, when the vessel is upon a wind, the strain may be equally divided throughout the whole frame of the vessel. *The whole of these parts must be put together with the most cautious attention to every point which can give the greatest degree of strength for binding the boats together, so as to make them in all respects inseparable from each other.*

A paddle or float of 18 feet, coming in contact with so large a body of water,

will meet with the necessary resistance; and the water in front, which so materially impedes the progress of a single-bodied vessel, passing through the water-way, will afford an admirable and most beneficial supply for the wheel to act upon, in addition to that at the stern of each of the boats.

The twin-boat not drawing, when loaded, more than about 30 inches water, and being relieved in front, would require far less power to propel it forward, than would be necessary to drive so dense a body of water back as must necessarily come in contact with the paddle or float, so that the whole power of the engine would be spent in promoting the speed of the vessel. In single-bodied steam-vessels of all descriptions, the engine power is divided in proportions nearly equal, in propelling the vessel forward, and driving the water back by the action of the wheel. That portion of the power spent in producing the latter effect is power lost.

Another incalculable advantage which attaches to a twin-boat, is, that it may with perfect safety carry a much greater proportion of sail, probably not less than three or four times, than any single-bodied vessel of the same tonnage. The reason is clear,—a twin-boat is not liable to a rotary motion, and therefore cannot be upset. If under a heavy pressure of sail upon a wind, the leeward boat would be pressed down in the water *bodily*, and before this could take place for more than a few inches, it must necessarily act upon the windward boat in the way of raising it up to a less draught of water: thus the windward boat would act as an outrigger, and would keep the leeward boat upon a level.

The twin-boat drawing but little water, would when upon a wind go rapidly to leeward, unless kept up to the windward by that simple but invaluable appendage the lee-board. Every twin-boat must be amply supplied with this appendage.

As a twin-boat, under the influence of equal power with a single-bodied vessel, whether of steam or wind, or both united, would proceed with far greater rapidity, so would be increased the necessity of the most perfect control and management of the vessel by the power of steerage. This appears to be a point of the greatest importance, both as it respects escaping danger, and being the cause of damage to other vessels. For this reason, I consider an additional rudder, placed at the bow, as indispensably necessary. A powerful rudder, placed in the centre, between the bows of the vessel, to work in unison with the rudder at the stern (see figs. 1 and 3), would probably increase the power of steerage fourfold. But it must be fully understood, that this bow rudder must in all cases, whether for twin-boats or single-bodied vessels, be fixed on an additional stem, as shown in figs. 1, 2, and 3, and thereby made to swing and steer precisely in the same way, and upon the same principle, as the rudder at the stern. The two rudders are to be altogether unconnected with each other, and must be worked singly, or in unison, by two persons.

I prefer the form of the bows of the twin-boat, as represented in figs. 1 and 2, because a water-course of 8 feet cannot, by possibility, without great disadvantage, dispose of a column of water of 14 feet, and consequently the vessel would have opposed to it a very considerable portion of breakwater, which would materially impede its progress. A body of 14 feet of water, constantly forcing its way through a water-course of 8 feet, would have a tendency to force the boats asunder; but upon the plan shown in the drawings, it would have the contrary effect of pressing them together.

No apprehension need be entertained of any impediment or inconvenience, arising from the depth of the float or paddle in the water, because the diameter of the wheel being considerable, and the vessel proceeding with greater velocity, the centre of motion would be rapidly receding from the line perpendicular to the point of the float or paddle, and the paddle would on this account rise from the water upon the proper angle, without subjecting the wheel to the impediment of lifting.

Such a vessel, schooner rigged, and supplied with an extra measure of sail, and light, compact, but powerful engines placed on deck, or one on the floor of each boat, selected from those which are used for propelling carriages on the common road, would be fully equal to propelling a twin-boat with three times

the velocity of a single-bodied vessel. It would be nearly impossible to throw this vessel out of a level by the power of the wind, so as to affect the working of the engine. It must be remembered, as a principle, that the wider the water-course the greater will be the stability of the vessel when upon a wind, and the longer the paddle the greater will be the resistance of the water.

I wish it to be fully understood, that I am not recommending this form of vessel for the purpose of carrying heavy burdens, or for proceeding on long and dangerous voyages; but as especially calculated for lakes, rivers (not canals), and short voyages to our own or the opposite coasts, in moderate weather. I see no reason why a twin-boat, as here described, should not reach Calais in six hours from Tower wharf, or, rather say, from Greenwich Hospital, after leaving astern the shipping in the river.

The coupling bar above at the bow, and the corresponding ones below, connecting the bows of the vessel together, furnished with eyes to carry the pintles of the rudders, and the breadth of 8 feet between them, will afford ample room for fixing and working a rudder of such dimensions as would instantly control and direct the bow of the vessel.

It would add much to the safety of the twin-boat if the two bodies were divided into compartments (like a coal barge, as shown in fig. 1), because, in case of a fracture, only one of them would fill, and that only as high as the load-water-line, or the level of the water in which it floated. But if it were found inconvenient to divide the whole length of the vessel, the bow ends should be provided with such chambers, because more liable to receive injury.

The principle of construction here developed may be applied to boats not larger than a Thames wherry, which may be driven by the manual labour (as well as by wind) of two men, with great rapidity, if built long and narrow, and the wheel be properly timed. The advantage of a rotary over the reciprocating motion of the oar is at present little understood.

I am, Sir,
Your obedient servant,
W. Aldersey.

Homerton, near Hackney,
August 9, 1834.

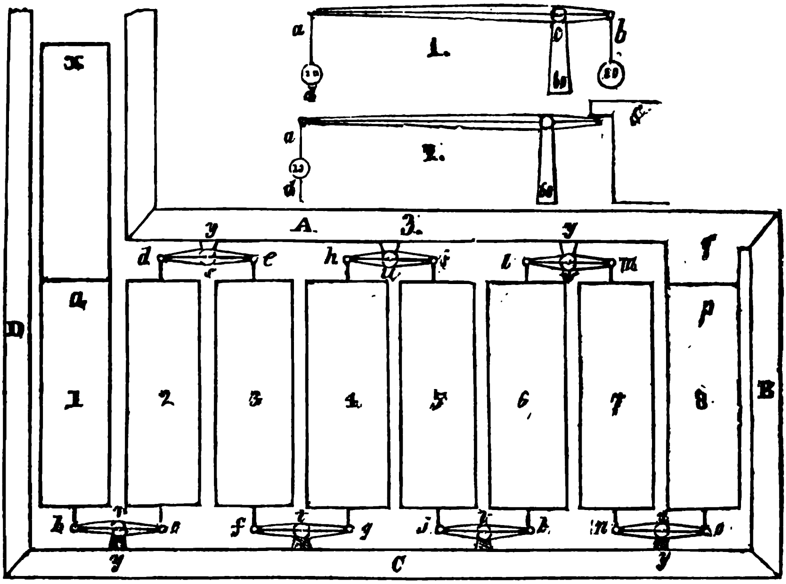
ANALOGY BETWEEN THE PRESSURE OF FLUIDS AND OF SOLIDS.

Sir,—I beg leave to propose (what I think would be acceptable to some of the readers of your very useful publication) a mechanical representation of the pressure of fluids, particularly of that which is commonly termed the hydrostatic paradox, showing that by a proper arrangement of solid levers, columns, &c., within a frame or box, an amount of pressure can be produced in the inside, equal to that which could be produced, supposing the inside to be occupied by a fluid; showing also, that if any degree of pressure be transmitted towards any given part of the interior of any vessel, the power of communicating it to other parts of the interior is not wholly confined to fluids. The insertion of this in your valuable Magazine will much oblige,

Your humble servant,
J. R. Aris.

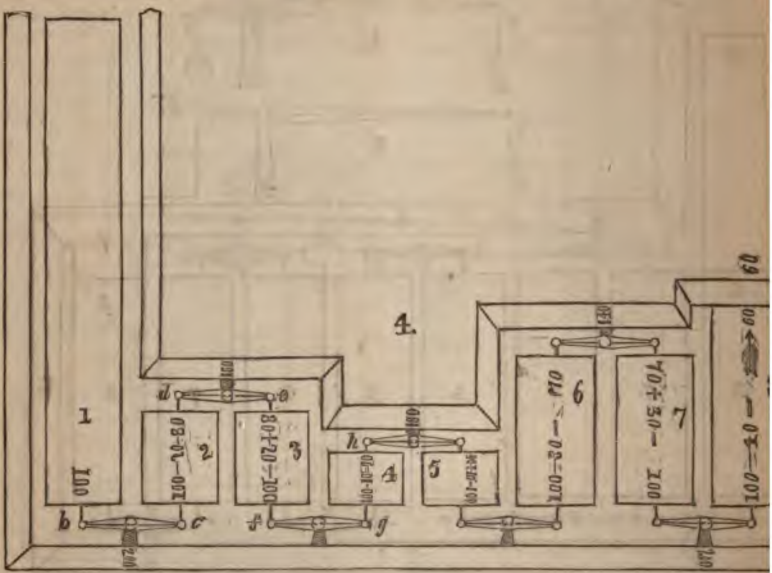
I shall represent the pressure produced (by such an arrangement) on the opposite sides only of a frame, or the top and bottom only of a box, leaving for the present the representation of the pressure on the other sides.

Before I proceed, it will be necessary to refer to the degrees of pressure (on the different parts of a lever and the fulcrum) produced by any given force. *a b*, fig. 1, represents a lever; *c* the fulcrum. Suppose a pressure be applied to the end *a* equal to 10 lbs., in the direction *a d*, this will cause a pressure in an opposite direction, on the end *b*, equal to 50 lbs., in consequence of the end *a* being at five times the distance of *b* from the fulcrum; therefore, to keep the lever in equilibrio, there must be a pressure on *b*, in a contrary direction, equal to 50 lbs.: this can be effected by suspending a weight of 50 lbs. on *b*, and this will also produce a pressure on the fulcrum equal to the amount on the two ends of the lever, viz., 60 lbs. If (instead of the weight of 50 lbs. being made use of to preserve the equilibrium) the end *b* of the lever, pressed upwards against the immoveable solid S, in fig. 2, the pressure on *b* would still be the same as that produced by the weight of 50 lbs. in fig. 1, because no degree of pressure downwards, less than



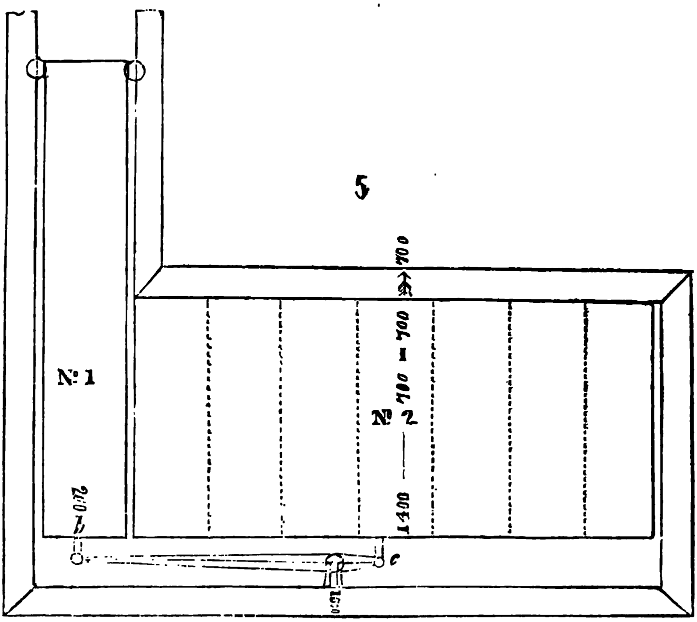
50lbs., could have preserved the equilibrium; consequently the amount of pressure on the fulcrum must also remain the same.

A B C D, fig. 3, represents a strong frame or box, in the inside of which are several levers, $b c$, $d e$, $f g$, $h i$, $j k$, $l m$, and $n o$, all of the same length, and the ends of all of them at equal distances from the fixed centres or fulcræ, upon which the said levers are moveable, which centres are represented by the letters r, s, t, u, v, w, and x. There is also a number of columns, Nos. 1, 2, 3, 4, 5, 6, 7, and 8, all of the same length and width, connecting the ends of the levers with those on the opposite side of the frame or box. The use of this arrangement of levers, &c., is to communicate any degree of pressure (that may be applied to the end a of column No. 1) to the end b of the same column, and from thence through the whole of the levers and columns to the end p of the last column (No. 8), which may be done in the following manner. Suppose a pressure equal to 100 lbs. be applied to the end a of column No. 1, the direction of the force being towards b, *the lever $b c$ being moveable on its centre of motion r, communicates the same degree of pressure* to column No. 2, in an opposite direction, from c to d; the lever $d e$ then reverses, and communicates the same degree of pressure (by means of the column No. 3) to f; the lever $f g$ will, in a similar manner, transfer the same degree of pressure to h; and so on, each lever communicating the same degree of pressure (by means of the next column directly attached to it) to the next lever on the opposite side of the frame or box, until it is finally communicated to the end p of the last column No. 8, resting upwards against the immoveable part q of the frame, and pressing on it with the same degree of force of 100 lbs., there not being any gain or loss of leverage (in the communication of the pressure to q) by any of the parts concerned in the communication. The motion of the end p of the last column, No. 8, being resisted by the fixed part q of the frame, causes a strain equal to 100 lbs. on p, and consequently on the ends of all the other columns and levers within the frame or box. The lever $b c$, in transferring the pressure to the opposite side of the frame, &c. (by means of the column No. 2), causes a pressure on its fulcrum or centre of motion r equal to 200 lbs. towards the outside of the frame,



which amount of pressure is exactly equal to that on both ends of the lever *b c*, as in figs. 1 and 2, and also on the ends of the two columns concerned in the communication, viz., 100l bs. each. And as the same degree of pressure is in a similar manner transferred to the opposite side of the frame, &c., by all the levers (by means of the columns directly attached to them), there must be the same amount of pressure, viz., 200 lbs. on the fulcrum of every lever within the frame or box; therefore the pressure sustained by the outside of the frame will be equal to 200 lbs. repeated as many times as the pressure is thus transferred: consequently the total amount of pressure outwards on both sides of the frame, &c., is equal to 100 lbs. multiplied by the number of columns communicating with both sides of the frame, which would be exactly the same if the columns were fluid, and the ends of them in actual contact with the outside of the frame or box. The only difference is in the manner of communicating the pressure. Instead of the columns being fluid, and the ends of them in actual contact with the *outside of the* frame or box, and pressing *separately upon* it with the force of *100 lbs. each*, the pressure of both, viz., 200 lbs., is transferred together fro centre of motion through the fulcr to the outside of the frame. In there are seven columns communi with the side A of the frame; the a of pressure, therefore, on it is eq 700 lbs.; and as there are eight co on the opposite side, the amount o sure on it must be equal to 800 l 1,500 lbs. on the whole. As the amount of pressure would take pl the opposite sides of the box, w filled with a fluid instead of the levers, &c., the arrangement des may serve to illustrate the principle hydrostatic pressure. The frame consequently the columns, &c., are posed to be in a horizontal positi that the weight of them would not any difference of pressure on the op sides of the frame, &c.

To illustrate the pressure produc the gravity or weight of a fluid, pla frame or box so that the columns t may be in a perpendicular position will thereby represent a series of flu lumns, the column *a b* weighing e 100 lbs., each of all the other co weighing the same. Now it is ev by inspection of the figure, th whole of them must be in eq



The columns attached to each end of the same lever being equal in weight, there will not be any pressure upwards from the tops of any of them, and the pressure on the bottom of the box will be equal to the amount of weight of all the columns within the box, viz., 100 lbs. each. And as there are eight columns in the figure, the amount of pressure on the bottom will, of course, be equal to 800 lbs. Therefore, this arrangement will serve to represent the amount of pressure when a vessel is filled with fluid, the pressure on the bottom being equal to the sum of the pressure on all the columns contained in the vessel, each column being equal in height and weight to the column *a b*, and there being no pressure upwards at the top. To represent the amount of pressure on the top and bottom of a box, when there is a tube or pipe carried above the top, and the other part of the top is quite closed: make the column No. 1 double the height, and consequently it will represent a column of double the weight also. *This column will (similar to* a fluid *column) cause a pressure* upwards at the *top of the box, equal to* the weight (of that part of the column only which is carried above the level of the top) multiplied by the number of columns communicating with the top of the box, and the amount of pressure on the bottom will be the same as if the box and pipe were filled with a fluid, that is, twice the amount of that, when the column No. 1 was not higher than the top of the box; consequently the amount of pressure on the bottom will be identically the same, if the top of the box were removed, and all the columns therein were carried up to the same height as the column *b a x* in the small tube. This is as much a paradox as that which is caused by the pressure of a fluid, or that which is commonly called the hydrostatic paradox—the increase of pressure on the bottom being always proportional to the increase of the highest column *b a x*.

If the top of the box were of any other form than that represented in fig. 3, whether it be an inclined plane, a curve, or any other irregular figure, the pressure on the bottom would be exactly the same, as it entirely depends on the height of the column carried above the top, which may easily be traced by

Hydrophobia.—The *Globe* has published a letter from Mr. J. Murray, in which he strenuously advocates the employment of chlorine as a means of both curing and preventing this dreadful malady, "I speak advisedly," he says. "This gas unhinges and renders altogether inert from decomposition the most virulent mineral, vegetable and animal poisons—as arsenicated hydrogen, hydrocyanic acid, &c., and it is more than probable that it would be proved equally efficient here. I applied strong nitro-muriatic acid (which evolves chlorine) to the wound of a man bitten by a mad dog; two years have since elapsed, and he has had no symptom of the disease. I also submitted a dog under the full virulence of rabies to an atmosphere of chlorine, and it was perfectly recovered. These cases surely speak volumes; and why medical practitioners should refuse to adopt this simple remedy, founded on such rational grounds, and with the full prospect of success, I cannot imagine; a predetermined scepticism, founded on an assumption that the question is hopeless, will not avail in the estimation of sober and reflecting judgment. A few months only have elapsed since the old routine was applied in a case which occurred at Leeds, which has been uselessly employed, and with little variation, since the days of Hippocrates and Galen, not only without any alleviation of the symptoms of disease, but even without a shade of relief from suffering to the individual. Surely this is irrational and unwarrantable; and if experiment grounded on legitimate principles be in any case admissible, it is especially so here. Many physicians have given to me in person their willing assent to my views, as the most rational of any they have met with; and I may assert, without fear of contradiction, that I have paid as much specific attention to this subject as any person now living. As a preventive, I confess I have little faith in excision, even when skilfully performed, certainly none if not immediately effected. Being quite convinced that this virus, like other animal poisons, may be safely taken into the stomach, I should not have the slightest hesitation in sucking the wound, had I the misfortune to be bitten by a mad dog; for, be it remembered, there is no time to be lost. A ligature above, and the cupping-glass to the part, are not only advisable but essential, and should be followed by the repeated application of a sponge saturated with strong nitro-muriatic acid, or chlorine. When the disease is manifested I consider the entire system affected, and therefore infer that no merely local remedy will do. The patient then should breathe an atmosphere of chlorine, that is, atmospheric air impregnated with it—as well as have the surface of the body exposed to its influence. With the application of these remedies I have no doubt of the happiest result."

Jacquard, the inventor of the silk-weaving machine which bears his name, died recently at Paris. For the last century Lyons produced but plain silks, a kind in which Switzerland and England can successfully compete with and undersell the French. But Jacquard's invention enabled Lyons to preserve the superiority in figured silks. "If Lyons," says a French journal, "has 32,000 looms, and if each loom does a third more than it did 40 years ago—if Lyons preserves its superiority, and extends its trade, despite of Zurich and its new silk fabrics, despite of Crevelt—of Elberfeld—of Austria's doubling its silk manufactures—despite of Saxony and Russia, and of the 40,000 looms of England, she owes all this to Jacquard." Jacquard, notwithstanding, died poor, at the advanced age of 82 years.

India Rubber Carpets.—Having some Indiar rubber varnish left, which was prepared for anothes purpose, the thought occurred to me of trying it a a covering to a carpet, after the following manner. —*A piece of canvass* was stretched and covered *with a thin coat* of glue (corn meal size will probably answer best); over this was laid a sheet of brown paper, or newspaper, and another coat of glue added, over which was laid a pattern of house papering, with rich figures. After the body of the carpet was thus prepared, a very thin touch of glue was carried over the face of the papers, to prevent the India-rubber from tarnishing the beautiful colours of the paper. After this was dried, one or two coats (as may be desired) of India-rubber varnish were applied, which, when dried, formed a surface as polished glass, through which the variegated colours of the paper appeared with undiminished, if not with increased, lustre. This carpet is quite durable, and is impenetrable to water, or grease of any description. When soiled, it may be washed like a piece of smooth marble or wood. If gold or silver form the last coat, instead of papering, and the varnish is then applied, nothing can exceed the splendid richness of the carpet, which gives the floor the appearance of being burnished with gold or silver. A neat carpet on this plan will cost, when made of good papering, about 37 cents a yard. When covered with gold or silver leaf, the cost will be about 100 or 150 cents a yard. —*Correspondent of the Guernsey Star.*

Crucible Furnace for Fusion.—Persons who wish to melt or assay steel are not aware how easy it is to obtain a melted mass of one or two ounces, in the space of twenty minutes, without the least difficulty, by means of the following arrangement. Make a hole in the bottom of a Hessian crucible holding two or three quarts,—put inside of this crucible the cover of a smaller crucible, so that it may rest at about three-fourths of the depth. Make, with a file, several notches around this cover to admit the air freely, having the knob of the cover uppermost. On this knob place a little crucible containing the metal, which must be covered, —put some lighted charcoal around it, and fill up with coke, so as to entirely cover the interior crucible. Connect this apparatus with a blacksmith's, or other, bellows, and keep up a constant blast, supplying the waste coal as it is consumed,—in the course of the time mentioned, the steel will be melted. Other metals, even some that are reputed infusible, will yield in like manner. This simple and cheap apparatus abridges time and labour surprisingly, and effects what with the common and costly furnaces would be impossible.—*Jour. de Con. Usuelles.*

Mr. Hancock commenced on Monday last running two steam-carriages regularly between the City and Paddington, and they have been plying throughout the week with uninterrupted success.

One of Mr. Russell's steam-carriages between Glasgow and Paisley, having been overset by the breaking of a wheel, the boiler burst, and five persons were killed. The Court of Session has, in consequence of this, interdicted the whole set of carriages from running—for the present at least. A fine specimen this of Caledonian wisdom! Why do they not also clear the Clyde of the whole of its steamers, since certain it is, that steam-boats have met with accidents as well as steam-carriages, and are as likely to meet with them again? It is impossible so absurd an interdict can stand.

Communications received from An Ex-Committee Man—Mr. Aldersey—Gravidus—Mr. Williams—S. S.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 577. SATURDAY, AUGUST 30, 1834. Price 6*d.*

TWIN STEAM-BOAT.

Fig. 1.

Fig. 2.

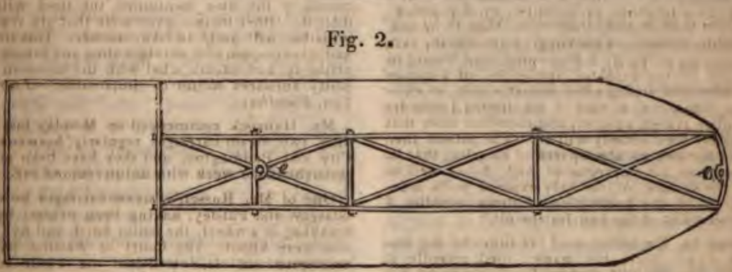
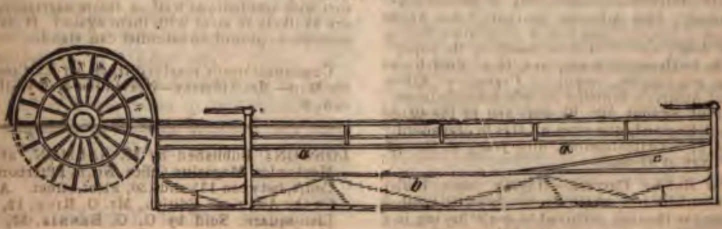


Fig. 3.



dissimilar; and my reason for supposing so is this — Mr. Webster, who gave lectures on the steam-engine about ten years ago, had a model of a steam-vessel, which was propelled by forcing water out of the stern, and so far the two principles were alike; but they differ very materially in some very essential points. Mr. Webster's plan consisted of a series of flat metal bars under the bottom, that swung upon horizontal hinges, and were worked, fore and aft, by the steam machinery; so that, in passing aftwards, it necessarily forced the water out of the stern, and, of course, propelled the vessel forward, but on the return stroke it produced no effect whatever; and this was, probably, the reason that it could not compete with the ordinary paddles. The paddles, in a vessel that is propelled by paddles, always act in the same direction, and, as one of the paddles is always in the water, the stroke must be *continuous;* whereas by the preceding method, and I am aware of no other that at all resembles mine, it is only the *alternate* stroke that has the power to propel the vessel forward. The back stroke, of course, produces no effect, and therefore only half the power of the steam is available in propelling the vessel.

In this essential point, then, my plan is manifestly superior to the preceding; for, by having two plungers, one of which will always be descending while the other is ascending, the stroke must incessantly be as continuous as that of the paddles; and, if the areas of the trunks and canals be equal to the area of so much of the paddle as is under water, when it is vertical, I can easily imagine that the effect may be much greater, but I cannot conceive how it can possibly be less.

Whether such a plan as this of mine has, or has not, been tried, I wish to have this paper inserted; because, by so doing, you may be the means of preventing others from building up similar expectations, which cannot possibly be realised: and I should also be glad to have the opinions of any of your intelligent correspondents respecting it. If, however, no similar plan has yet been tried, it may be deserving of the consideration of some of the steam navigation companies, because, if upon trial it should be found to succeed, it might [b]e productive of very beneficial conseq[uences]; and I, of course, cannot expect to [derive] any other advantage from it th[an the] simple gratification of, in some [degree,] benefitting the community. T[he ex]pense of having the model of a bo[at that] can be propelled occasionally, ei[ther by] paddles or upon my plan, would [be] a trifle to any steam navigation co[mpany,] and if, as I think is probable, th[e velo]city of the boat would be increa[sed by] the adoption of my plan, it migh[t be at]tended with very great advantage[s to the] company. I am, Sir,

Your obedient servant,

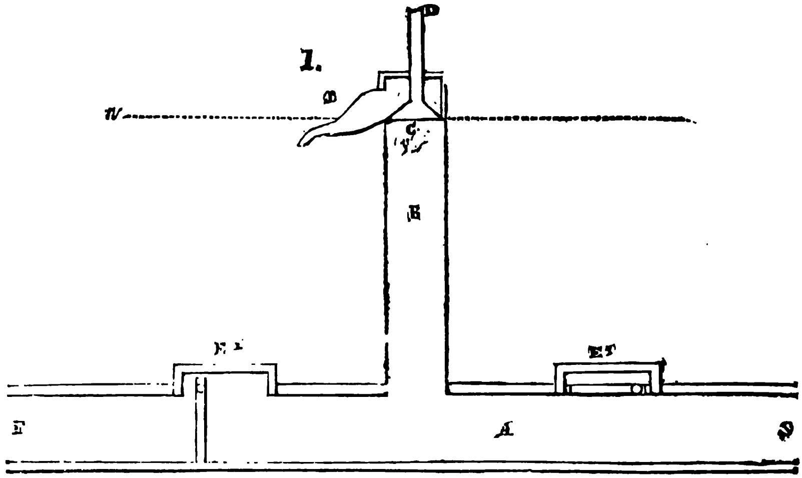
WALTER FORMA[N,]

Commander Royal [Navy.]

Plan for Propelling Steam-vessels [without] Paddles.

Instead of the paddles, I pro[pose to] have two *straight* and, of course, [...] metal canals, one on each side [of the] kelson, so that one end of each wi[ll com]municate with the water throug[h the] bows, and the other through the [stern] frame. The areas of these canals [...] be about equal to the area of j[ust so] much of a paddle as is under wate[r when] it is in a vertical position. These [canals] will, of course, be always full of [water,] but this water will answer the pur[pose of] ballast; and as they will be [placed] in the bottom of the steam[-vessel] (on each side of the kelson), the[y will] scarcely occupy more room in the [hold] than what is usually required for b[allast.] In each of these canals, and in an[y part] of it that may be considered most [conve]nient, I propose to insert a metal *v*[ertical] trunk, the top of which is to reach [...] *six inches* above the water line, as [re]presented in fig 1.

The *interior* surface of these trun[ks is to] be ground smooth, to prevent frictio[n; and] in each of them a *metal* plunger is [to be] placed, as is represented in figs. 1 [...] which must be ground to fit th[e] sides of each, so that it may slide u[p and] down *freely*, without being imped[ed by] friction, and connected by a ro[d and] parallel motion to a lever-beam. [The] lever-beam is be worked by the [...] rod of a steam-engine, so that on[e of the] plungers will descend as the ot[her ...]



cending, and the two strokes will necessarily be continuous.

In each of these *horizontal* canals is to be a strong metal door, to open *upwards* into a recess, and close *downwards.* One of these doors is to be placed before the vertical trunk, and the other abaft it; and one of them is to be always open when the other is shut, as represented in fig. 1; and it may be so managed that, by turning a wheel, the one will open as the other will shut; so that the vessel may be backed or propelled, in an instant, by merely turning two wheels; that is, one for each canal.

Description of the Engravings.

Fig. 1.

A, represents a strong metal canal, passing, in a straight line, through the steam-vessel, and communicating with the water at the stem and stern;

B, a *vertical* metal trunk, *of the same area as the canal*;

C, a metal plunger;

D, plunger-rod;

E^1, E^2, two doors moving up and down on hinges, to open and shut the communication with the water, as necessary. In this figure, E^1 represents the foremost *door shut to prevent the* communication *with the plunger and the* water forward; *and E^2 represents the* aftermost door *open, to allow a* communication with the *water aftwards;*

F, is the fore part of the canal;

S, the after part of the canal;

w, *w*, mark the water line; and

x, is an eduction box, for the conveyance of the water that escapes *upwards* between the plunger and the sides of the vertical trunk, and which is carried off by a pipe into the well.

Fig. 2.

A A, the two horizontal canals;

B B, the two vertical metal trunks;

C C, metal plungers;

D D, plunger rods (N. B. *the plunger rods, to be worked upon the parallel motion principle)*;

L, lever beam;

P, metal pillar, fitted into the kelson;

w, *w*, the water line; and

O, the orlop deck.

Fig. 1 represents a side-view section of one of these trunks, with the plunger, at its highest degree of ascent, on a level with the water line; the other trunk and plunger are supposed to be on the opposite side, concealed from view. Fig. 2 is a fore and aft or end view section of the same machine, in which both trunks are visible; and the plungers are supposed to be worked up and down by the steam-engine piston rod, which is attached to the lever beam.

N. B. The two doors, E^1 and E^2, are so connected by clock-work, that the one always opens as the other closes.

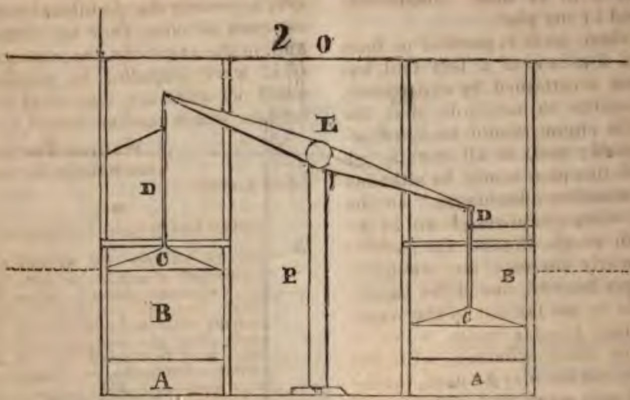


fig. 1 the foremost door is closed, so that, as the plunger descends, the water is driven out aftwards, and the vessel is consequently propelled forwards; but if we open E[1] and close E[2], the plunger in descending must necessarily force the water out forwards; and this, of course, will reverse the motion, and cause the vessel to back sternwards.

Remarks.

These plungers are worked up and down by the force of steam, which acts upon one of the arms of a lever beam; and, as one of them cannot ascend without the descent of the other, there must necessarily be a continuous descending stroke, which, when the door E[1] is closed, will propel the vessel forward; because, as the plunger descends, she must move forwards to make room for the water to be forced downwards by the stroke: for, if the areas of these trunks and canals are equal to so much of the area of a paddle as is under water when it is vertical, the resistance of the external water to that which is forced out of the canals by the descending stroke of the plungers, will be just equal to the resistance of the water that is opposed to the motion of the paddles (that is, however, on the supposition that the force of the piston rod of the steam-engine is the same); and, on the ascending stroke, the water will necessarily flow in and fill the trunk as *fast as it will be permitted by the plunger, so that* there will be no delay *on that score.*

I have already observed, that these plungers are to slide freely up and down without friction; and, if they fit the trunks so far, the small quantity of water that will escape upwards between the plungers and the sides of the trunk, and which will pass off through the eduction pipe to the well, will be of no consequence.

I have now to make out a probable case (for the fact has not yet been proved by experiment), that, with the same power of steam, this method would rather increase the velocity of the steam-vessel, and would not be attended with any commotion in the water.

It is well known that the sole cause of the commotion in the water is the rotary motion of the paddles; for, if we tow a square vessel, with perpendicular upper works, through the water with ever so much velocity, the commotion of the water, in consequence, is too trifling to deserve consideration; and as, in this instance, the pressure on the water *will always act horizontally,* and will, moreover, be 3 or 4 feet below the surface, it cannot possibly be any greater; and it is reasonable to suppose that the velocity of the steam-vessel will be increased from the following considerations:—In the first place, we cannot convert a reciprocal motion into a rotary one without a great loss of power, and as my engine does not require a rotary motion so much power will be gained; in the second place, a great part of the time that the rotatory paddle is in the water, it acts obliquely downwards or upwards, and not in

ntal direction, which must neces- diminish the power of the en- and thirdly, the paddle wheels elves, and the bulk-heads that them, impede the velocity of the , and both of these obstructions moved by my plan.

far, then, as it is possible to form inion, *à priori*, of a fact that has t been ascertained by experiment, reasonable to conclude that the of the engine would be consider- insreased; and, at all events, the ion of this plan would be attended two manifest advantages. In the lace, when steam-vessels are in the sea in rough weather the paddles be nearly useless; for, whenever oll very heavily, one of the paddle s must be too far out of the water, he other too far under water to ce any effect, whereas, with my d, the engine may be used, let the be how it way; and secondly, if -vessels made use of plungers, in- of paddles, there could be no ob- to the employing of them on ; because, as they would produce nmotion in the water, they could r wash down the banks, nor upset oats that might happen to be pass- iere, which is frequently done by addles of steam-vessels on the Thames.

this plan should be adopted, it be necessary to have two canals fore and aft through the vessel; may perhaps be urged, as an ob- n to it, that by opening a commu- on with the fore part of the ship her ty would necessarily be impeded. is I reply, that a remedy for this sed inconvenience may be very contrived; for we have only to two doors, that will exactly fill up vo vacancies, made to swing freely rtical hinges, so that when the ship ving forwards, these doors will close ir own accord, and whenever it is sary to back astern, they will easily way for the rush of water that will ced forwards by the plungers.

the length of the stroke of these ers need not be more than two feet, orlop deck should be so much as feet above the water line, the whole machinery would be beneath the deck, and in a great measure shel- from an enemy's shot; because, in this case, a shot must necessarily pass through the thickest part of the deck, and probably be nearly spent before it could possibly touch any part of the ma- chinery; whereas there is nothing what- ever to protect the paddle-wheels, *which are open to view*, from an enemy's fire; and, in the event of a war, a steam-vessel, *if it were propelled by paddle-wheels*, could not with any degree of prudence venture within random shot of an enemy.

WALTER FORMAN,
Commander Royal Navy.

July 1, 1834.

EXPORTATION OF MACHINERY.

"On the 1st inst. Mr. George Swainson, a surveyor of customs, on going on board the Columbine steamer, bound to Ham- burgh, had his suspicions excited by a package which had been shipped as a mill- shaft, and the external appearance of which bore that description. Upon a very minute examination, it sounded hollow, when Swainson ordered a hole to be cut in the middle, by which he found that the ex- ternal part was an entire deception, and made into the form of a mill-shaft. It proved to be a case, 15 feet long, containing 2,950 spindles for bobbin-net machinery, which he seised and delivered at the King's ware- house, where it was valued at 140*l*. A simi- lar seisure of bobbin-net machinery was made in a steamer bound to France, a few weeks ago."—*Sheffield Mercury, Aug.* 16.

That there should be such a law in existence as has been enforced in the instance above quoted (which, we regret to say, is by no means a solitary one), is a disgrace to the intelligence of the country. It is due, however, to the Go- vernment to state, that it is not enforced either at their instance or with their ap- probation; they disapprove of the law, and would be glad to see it abolished. Most of the recent informations for the exportation of machinery may be traced to the instigation of an association of bobbin-net manufacturers, which has been formed at Nottingham, for the *im- practicable* purpose of keeping the whole manufacture to themselves, and who have emissaries prowling about in all directions, in quest of cases for prosecu- tion. The folly and vexatiousness of these proceedings have been very ably exposed in some admirable letters in the *Nottingham Review*, signed "Observer," from which we shall take the present opportunity of making a few extracts:—

"I conceive, sir, the only object of the pro- moters of the present prosecutions, is to pre- vent the growth of the foreign manufacture,

by restricting the supply of machinery; and if England were the only source from which, at present and in future, it could be supplied, their project might be feasible. But, sir, of the 2,000 machines said to be now in France, certainly not one-fifth, perhaps not one-tenth, of the carcasses were built in England, and probably not near one-third of their insides were made here; and what is to prevent the French from building in future? The very existence of that number of machines in France, is an ample proof of the existence of the means of increasing French machinery to any remunerating extent. In Calais alone are 150 men employed in building carcasses; they are chiefly Frenchmen; and machines may be seen there, doing a respectable quantity of work, made, (both carcasses and insides) set-up, managed, and worked, entirely by Frenchmen, and composed entirely (except in tin) of French metal. In all France there are somewhat more than 200 hands employed in making insides; of these probably one-fourth are English: shops there are, some composed entirely of French masters and workmen, others chiefly of French workmen with English masters and foremen. The quality of the work is very various: some is inferior to what is now usually made here, but quite equal to what was made six or eight years since: other, has little cause to fear from comparison or competition from any quarter. French metal, both iron and brass, is much better now than it was some time since. As was the case when the manufacture of lace machinery commenced in England, their metal was some time since not of a quality well suited to the purpose, but (also, as in England) now that the demand has become sufficiently large to induce attention to it, the makers have much improved, and are still improving it. In several important districts of the French lace trade, there is scarcely an English-made inside to be found. Except even the existing obstructions be removed, there need be little fear of exporting insides to France: a short time will stop that practice by much surer means than the active gentlemen now employed can take, viz. by the ability to make them cheaper there than (with expences and the present French duty on them) they can be sent from hence. If any person doubt the truth of these assertions, inquiry is easily made; many residents of Nottingham have friends in France: let them ask them. Under these circumstances, it is impossible that the extension of the French lace manufacture should be even temporarily checked, by our refusal to supply them with machines.

"It will be observed, that the establishment of the lace trade in France has been effected, not so much by the exportation of machinery, as by the emigration of workmen. Every one personally acquainted with those at present engaged in it there, knows that the most active and important English manufacturers and workmen in France, are chiefly those who emigrated previous to the repeal of the act which made such emigration penal. From this circumstance, the reader will judge of the expediency of the proposed re-enactment of them. Surely the prosperity of British manufactures does not depend upon laws ineffectual and unjust as these.

"With respect to the supply of bobbin-net machinery to other countries, there exists no impediment to the exportation of such machinery from France. The greater part of the machines now in Vienna were built in Calais and Lisle; and machines are now building in France for exportation. It was but a slight circumstance which prevented two Englishmen resident in France, from acceding to offers for superintending the building of machines at Moscow. Indeed most of the machines yet at work in all continental countries, have been built either in France, or by workmen who have gone to those countries for that purpose.

"There are probably 300 workmen of all descriptions, now or lately employed in England in the manufacture of lace machinery for exportation: if such exportation be prevented, it is clear that these workmen will be discharged; indeed, your paper of last week informs us that this has already taken place to some extent. Now, sir, if it still be thought profitable to work lace machines in the countries for which they have been ordered, what is to hinder the emigration of the discharged machine-smiths? and, if it could be prevented, would it be just? And it will be borne in mind, that a removal to France is not now the kind of affair it was thought some years ago: so many workmen have passed and repassed, that the road has become perfectly familiar; and too many are now living there for any to fear the want of society. The immediate refuge of these hands will be either France, where the demand for machinery is at present very considerable; or, under higher offers, to the more distant countries desirous of possessing them. If any remain behind, they will continue to be a weight on the trade, lowering by competition the wages of their fellow-workmen, and eventually the value of both new and of existing machinery. The mistake usually made on subjects of this kind, is to reckon upon the machinery or other goods actually produced, instead of the power which exists of producing them. In the present instance it is taken for granted, that all that is wanted is to prevent the making of machinery for abroad, without considering that while the power to make it remains, the possessors of

ower, whether workmen or employers, nd in most cases must, find purchasers and as the possessors of all other sale- rticles do, when they meet with any lty in disposing of their goods, they find such purchasers through new gs, or by lowering the price in the rket.

e sole question to be determined, there- , whether it is better to export machi- r the makers of machinery? At pre- ach machine sent abroad will work great disadvantages; through the mis- protective system adopted by most ental states, the produce of that ma- is inevitably confined to its own market; hat machine had remained in England, ld have come into equal competition ts neighbours, and its produce would one side by side with theirs into all the ts of the world. In exporting machi- it is true that the means of making a n quantity of an article like that made re sent away, but it by no means fol- that if it were not made abroad, it be bought from England, or even t at all. But by driving away her s of machinery, England furnishes to ontinental states the means of making antity of competing machinery, with- e important countervailing advantage ining here the skill and experience by it had been constructed. Of course st workmen will be selected for emigra- and every one at work abroad will en others.

would be by no means difficult to shew, ising manufactures are the inevitable uence of a long cessation from war, of ty of person and property, and pre- ntly of the extension of constitutional m;—that these improving interests not occasion either envy or alarm;— at as it is impossible to confine manu- es to England; the surest, and indeed ly way to secure our manufacturing ority, is to allow the free exportation chinery.

* * * * *

n unsound principle generally shows llacy and mischievousness when sup- to be extensively applied. What rea- there for prohibiting the exportation chinery, which the makers of machi- might not urge for that of iron and ? The bleachers, dressers, runners, s, spotters, &c, &c., might equally ex- against the exportation of nets in the . The cushion lace makers may next protection against machinery, and machinery against power. Are the ittee aware to what an extent they are ring future restraints for themselves? spinners and doublers, on the same principle, may be required to keep all their thread at home, that foreigners may not have the employment which we ought to have in working it up; and it is right that the manufacturers of thread should know that this proposition was made at a recent meet- ing at Loughborough, and generally ap- proved; it was deferred solely because it was judged inexpedient to press it JUST NOW. In the same manner, the worsted spinner may demand a restriction on wool; the hosiers a similar one on yarn; the stocking- maker requires a charter and a minimum of wages; and the landowner insists that nei- ther shall mechanics emigrate, nor foreign corn come to them; the wiseacres of all other trades follow each other in the same round of restraint, and if perchance, each obtains an additional price for his own goods or labour, he pays through the same process that additional price or more to others; while so much energy is wasted by the scheme, that foreigners find they can pro- duce the goods they want cheaper at home. Thus schemes of imaginary protection, at the expense of others, out-general their own wisdom; this narrowness of view leads only to profitless, selfish effort, and in good time we reap the marvellous advantages of a people who rob each other all around, and then duly dividing the spoil, think themselves wonder- fully enriched by the process."

RECENT AMERICAN PATENTS.

(Selected from the Franklin Journal.)

PULP SIFTER—*S. A. Sweet, Tyringham, Massachusets.*—Instruments for the purpose to which that before us is applied, have been usually called *pulp-dressers.* That now patented is very simple in its character, operating like the common sieve. A plate of metal is to have slots or openings made through it, of such width as will permit the finely-ground pulp for paper to pass through, whilst it will detain the knots and lumps which may exist in it. This plate is to be surrounded by a wooden frame, of such height as will allow the prepared pulp to be passed into it, and to this strainer is to be given a jarring motion up and down, by which it is to be made to strike upon any hard substance. The mode of filling it with the pulp, and of giving to it the requisite motion, is left to the determination of the user, as it is stated that these things may be effected in various and obvious ways.

REVOLVING SPINNER—*W. Allen Potter, Rhode Island.*—This is a new and peculiar arrangement of the rings used instead of flyers in what has been called the ring spinner. The rings surrounding the bob- bins are to have grooves on their outer edges, a light band carried by a horizontal

pulley at the end of the frame being employed to drive them. This band is to be borne up against the rings by pairs of small friction rollers situated between each of the rings, and sustained on the same horizontal metallic plate which sustains them; the pins upon which these rollers turn, pass through slots in the plate, in order to increase, or to diminish, the pressure of the band upon the revolving rings, and consequently the strain upon the thread which passes over a hook or pin on each ring.

Damper Sugar Furnace—*Joshua Jordan, Boston.*—The patentee states that his furnace comprises " an improvement in the mode of constructing sugar furnaces and setting kettles for manufacturing sugar, so as to prevent the sugar from burning during the operation of striking, or removing the same from the granulating kettles to the coolers, and for other purposes therewith connected." The principal object in view, however, is the preventing of the burning of the sugar in striking. In constructing the furnace, the fire is made to pass directly under and through a flue around the granulating kettle, before it reaches that for evaporating, so that, by means of the damper, it can be prevented from acting on the granulating, without interfering with its operation on the evaporating and clarifying kettles, while the striking is going on. Between the bottom of the granulating kettle, and the fire, a damper of a peculiar construction is to be introduced during the striking. This damper is a vessel of copper, made flat in the form of an oblong square, of sufficient width and length to cover the fire, and hollow so as to contain water in the cavity formed between its flat sides, which water cannot escape excepting through a safety tube, extending up from its outer end. Above the furnace door there is another close to the bottom of the kettle, and of such size that when open the damper can be passed through the opening. This damper is placed upon a carriage, which runs upon a railway in front of the furnace, and when wanted it is brought up and slid in through the opening from off the carriage, the same serving to remove it when it is no longer wanted. Another damper, similarly constructed, is placed vertically between the granulating and evaporating kettles. When this is down in its place, the fire passes freely through a suitable opening in it for that purpose; but when raised, by the aid of pulleys, the opening between the two kettles is closed by an imperforated part of the damper. There are in the drawing a number of the parts of the furnace represented which are without written references; the general plan, however, is sufficiently apparent, although no specific claim is made.

Improved Mode of Generating Steam—*Isaiah Jennings, Philadelphia.*—The improvement here patented is stated not to be in any way dependent on the particular form of the boilers used, but upon the manner in which such boilers are filled or charged with water, in combination with other substances. " My invention," says the patentee, " principally consists in the placing within a boiler spongy, porous, or solid substances of various kinds, so as to fill, or nearly to fill, its internal cavity, with the exception of the spaces between, or within such substances. As, for example, I prepare globular or irregular lumps of wood, of such diameter as may be found convenient, say from 3 inches to 1 foot, or more, in diameter; or, instead of balls, I use pipes, or round sticks of wood, perforated with holes; which sticks, or pipes, are to be piled within, and along the boiler, until it is filled, or nearly so. Instead of wood I sometimes employ reeds, canes, or stalks of various kinds; taking care, however, that the substance be such as will not be readily reduced to pulp by boiling in water. I sometimes prevent the vegetable or other substances so placed within the boiler from coming in direct contact therewith, leaving a cavity all around them to be occupied by water, which may be done in various ways. Let there, for example, be cylindrieal boilers, in which this is to be done. I make a cylindrical vessel of wood, cut and fixed together like the staves of a barrel; this cylinder may be 3 or 4 inches less in diameter than the interior of the boiler; it should be perforated with holes, and is to have spikes or pins, driven into it, over its outside, extending out, so as to bear against the sides of the boiler; this will leave a space, as above mentioned, of from 1½ to 2 inches, more or less, between the wood and the metal. The wooden cylinder is to be filled with blocks of wood, or other materials, in the way already described. For steam-boilers used on land, where an increased weight is not objectionable, I sometimes use more solid materials than wood; such, for example, as large pebble stones, which, although they do not possess all the advantages of porous substances, yet, from their durability, will, in many cases, be preferred. The increased surface obtained by thus charging the boilers, especially when the softer and more porous woods are employed, occasions a great increase in the production of steam, exceeding, it is believed, that which can be safely obtained by any other arrangement, where the actual quantity of water within the boiler is so small as in that above described. For filling with water, I use such supply pumps, or other means, as are already known, and add a steam-chamber, or such other appendages, as may be found convenient."

ON "TREATISE ON THE RESIST- OF WATER TO THE PASSAGE OF 'S UPON CANALS AND OTHER ES OF WATER, &c. By JOHN NEILL, M.R.I.A., Member of the tution of Civil Engineers." By A -BUILDER.*

'76 and 1778, the French Academy d some experiments to ascertain the resistance to bodies passing through which were conducted by Bossut and The principal object of the experi- ade in 1776 was to ascertain the re- of bodies of known dimensions mov- certain velocities. The experiments upon the whole, to have been con- vith care, and the results are useful, ximations to the truth, though they a source of error, arising from the ascertaining the resistance by means ts attached to a silken cord, which rom the model under one pulley near ace of the water and over another at lerable elevation. The length and of the line, its exposure to the cur- air, and its varying friction through r, together with the friction of the or sheaves over which it passed, ffect the results, and prevent the cor- cation of the ratio between power ocity. The moving power, in no pears to have exceeded 24 lbs., nor ocity 2½ miles per hour: yet "the result was that the resistance was in leate ratio of the velocity." The ex- ts of 1778 were conducted by Bossut ndorcet, whose object was to ascertain tance to bodies of different forms at velocities, but being made with the chinery as those in 1776, the results to the same objection.

he close of the last century, the for the Improvement of Naval Ar- re made a very extensive series of nts to ascertain the velocities and e of bodies of various forms and Fulton availed himself of their re- his calculations for the application to navigation in North America; worthy of remark, that, erroneous ire, they yet furnished him with a which he arrived at an approxima- tion to the truth, as proved by actual experience.

In 1799, some very interesting experiments were made by Charles Gore, Esq., with the apparatus of the Society, for the purpose of 'ascertaining the comparative resistance of fluid water on floating bodies of different forms applicable to the construction of ships.' He made use of a constant motive weight of 1½ lb., with models of different forms and weight. After showing the advantage of great length and slight immersion of the body in the fluid, he remarks,—"the form best calculated for velocity is a long parallel body, terminating at each end in a parabolic cuneus, and having the extreme breadth in the centre. Also, making the cuneus more obtuse than is necessary to break with fairness the curve line into the straight, creates a considerable degree of impediment. And I am inclined to think, from what I have stated, that the length of ships, which has already been extended with success to four times the breadth, is capable, with advantage, of still further extension—perhaps to five, and in some cases even to six times."

In 1827 (May 31), Mr. James Walker, civil engineer, read to the Royal Society of London a paper on the laws which regulate the resistance of fluids, in which he observes—"It has lately acquired a new importance from the introduction of steam in navigation, rendering the ratio between power and velocity essentially necessary to be known. The comparison between canals and rail-roads, to which public attention has of late been much directed, depends also upon the ratio between the resistance and velocity by each of these modes of conveyance. * * * It has been demonstrated and proved, in the most satisfactory manner, by various experiments, the resistance from friction to a carriage upon a rail-road is the same at all velocities. I know, therefore, that the same strain upon a waggon which has the effect of moving it upon a railroad at the rate of 1 mile an hour, will (after the inertia is overcome) be indicated at any other velocity at which the power is made to move; but I have not found any theory or experiment by which, after knowing the strain upon a boat moving at the rate of 2 miles per hour, I have been able to fix satisfactorily the strain that is exerted upon it when moving at the rate of 4 miles per hour. The resistance of the fluid, per se, increases in the duplicate ratio of the velocity. Ex-

* Notes were committed to paper before had an opportunity of perusing the criti- Mr. Macneill's Treatise, published in the g. of the 30th November last, or had any anticipate so strong a coincidence of s exists between them. Only so much, of these Notes are now published, as con- a new information on the points at issue, in some new point of view the pretensions thor of the work under consideration.—

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ent have fallen, as to prove that s ought to be preferred to rail-roads, , in our humble judgment, he has y failed to do.

* * * * *

. Macneill informs us that "experi- were instituted in order to confirm aw of resistance, but that it occur- o none of the experimentalists, al- h they could not increase the density ater and harden it, as has been with roads for carriages, they could increase the relative resistance of by giving the boat such velocity he could not penetrate fast enough, hus that she would rise out of the ' They might, he adds, "have rea- by a perfectly fair analogy between yance on land or on snow and con- ce on water, and have *legitimately* ided that as their object was not to hrough gravel, but to get on it in le case, so at high velocities in the they should not have endeavoured o cut through the water, but also to the boat to the surface, and make kim thereon," even as the school- nakes a stone skim the surface of the . To show that there is nothing absurd notable scheme of sending first-rate of-war *skirling* along the surface of ean, Mr. Macneill tells the follow- ost marvellous story :—

ourteen years ago Mr. Robison, Se- y to the Royal Society of Edinburgh, formed by Mr. Perkins that upon one rivers of the United States he had ed a barge (length sixty feet, and ten f beam) loaded with hay so acted upon trong wind, that the barge appeared to bout *three feet* above the water-line, o skim with very great velocity upon rface of the water."

w the reader will please to bear in that a barge of the above-named sions is about 4 feet deep on the nd when light (empty) would draw 0 inches water; if loaded with hay e manner that our river barges are, ould then draw from 2 ft. 3 in. to 5 in. water, so that Mr. Perkins' must have been raised actually 6 in. the surface of the water!!!

* * * * *

Mr. Macneill's experiments at the nal Gallery of Practical Science miles per hour *is taken* as the *rd velocity; but in the first* series of eight experiments made under the same circumstances, we find a variation in the force of traction between the theory laid down and the actual experiment amounting to .059 lbs.—the force of traction or weight on the towing-line during each experiment, being 0.468 lbs.; and the force of traction calculated as the squares of the velocities is in the 3rd experiment 0.508 lbs., and in the 5th experiment 0.449 lbs. We are left to account for such different results in the best manner we can, as the column entitled "General Observations" contains no remark on the subject. It appears probable that the weight of the line and its friction through the fluid affected the results very considerably in the first or standard experiment, so that .468 lbs. is not the true value of the "force of traction" acting on the boat. If this supposition be correct, it follows that the deductions from the standard experiment are erroneous, and that we must commence *de novo* from more correct data.

In the 68th experiment, with a motive power of 20 lbs., the velocity of the empty boat appears to have been 6.392 miles, and "the force of traction during the experiment" 3.156 lbs.—In the 63rd experiment, with the same motive power as in No. 68, the velocity of the empty boat appears to have been 7.053 miles; a difference of $\frac{2}{3}$ of a mile under apparently the same circumstances. In the higher velocities similar discrepancies are to be found. Examples 88 and 91, with the same motive power, gave, the one 10.765 as the velocity, and the other 12.784 miles; whilst No. 92, with the same motive power only, attained a velocity of 10.227 miles. Again, in experiment No. 93, with a motive power of 80 lbs., a velocity of only 10.765 miles was obtained, whilst, with the same power, Nos. 98, 99, 100, and 101, a velocity of 12.784 miles was obtained, or upwards of 2 miles more.

We are afterwards presented with the details of some experiments made on the Paddington Canal with one of the Paisley Canal Company's quick boats, which are thus pompously introduced :—

"The important effects which they are calculated to produce in the minds of the unprejudiced, not only upon inland navigation, but to nautical science in general, have determined me to publish them in the fullest

nse of power which cannot be in-
ed in ordinary cases.

fore Mr. Macneill writes again so
dently about conferring obligations
utical science, we would suggest to
the propriety of first making himself
inted with, and understanding tho-
ly, what others have done for the
ce before him. He may then, per-
ce, discover in what he now igno-
y calls "the *etourderies* of the past,"
sound sense and practical skill, than
r the present or the future will ever
ble greatly to surpass. The ship-
er may not possibly have carried his
o its highest attainable perfection,
e has carried it at least far enough
ntitle him to protection from the
s of such *surface-skimmers* as Mr.
eill. B.

CLAIMS OF MATHEMATICAL SCIENCE.
EXPLANATION.

,—If it be in reference to my article
athematical pretensions, that your
spondent, Mr. Frend, has raised an
al in behalf of *mathematical science*,
s undertaken a superfluous task, and
himself very unnecessary trouble;
have not said, nor is it my wish to
a single word to the discredit of
science as simply considered, but
as connected with its abuses, its
ature, insufficient, or inappropriate
cations, and its inordinate claims:
d, I distinctly protested against
so misunderstood or misrepresent-
All, therefore, that your correspond-
ys about "the useless race of men
l mathematicians," and "the sinful
ise of acquiring a knowledge of the
sis," with other similar remarks, is
flourish, and is unworthy of a can-
or even of a staid and sober writer.
y be worth while to repeat, that my
t was to show that mathematical
ledge has a high value and intellec-
ank, only as associated respectively
habits of philosophic investigation,
practical application; and that these
having for their object the world
eral, are more extensively involved
more important interests of man-
and exist not only *in the* utmost
tion independent of a knowledge
thematical science, but in most
ases, to far more useful purposes, when untrammelled by its spirit and its forms.

However much it may be a work of supererogation, your correspondent, it seems, proposed to himself to advance "a few words in behalf of *mathematical* science;" but by a strange omission, or some hallucination of the mind, all that he has actually said, is in behalf of *practical* science, for in the historical sketch with which he has favoured us, of the several attempts to form an achromatic lens, he has satisfactorily substantiated my assertion, that success was attendant only on experimental research, and that Euler failed because, as he says, "pure intellect was the region of all his speculations." Though calling on me for a reply, he has rendered it unnecessary, by thus answering himself, or rather, by answering the appeal which he *intended* to have written in behalf of his favourite science. Thus again he says, "Mr. John Dollond, *after many optical experiments*, discovered that the refraction of two prisms when made of different kinds of glass might be equal, and that the difference of their refrangibility might be considerable; and that there might be equal divergency, with different degrees of refraction, in short, that refraction might be produced without colours. *Acting from these principles*, Mr. Dollond was the first artist that produced a correct achromatic refracting telescope." I could not wish to reply to Mr. Frend with more pertinent remarks. Here was a signal triumph, in a pitted contest as it were, of experimental and practical skill, over mathematical and speculative science. Euler in the self-sufficiency of his might, drew his materials for reasoning from himself, from "the region of pure intellect," and barreness was the result. Dollond, on the contrary, notwithstanding his undoubted mathematical acquirements, and without the least disparagement to them, applied to nature, the fountain head of knowledge, and she rewarded him with a splendid discovery. It were idle to ask, which mode of proceeding was the more characterised by wisdom and philosophy.

Mr. Frend says, that Newton stands as to this particular, at least, in the same predicament with Euler. That is a debateable point; but I may not enter on it, it being irrelevant to the subject in discussion; for the "appeal," which your

correspondent has volunteered, is "in *behalf* of mathematical science," and not with a view to make the matter worse by implicating others. Besides, he claims to be the defender of "mathematical *science*," and not of one of its professors at the expense of another.

I here beg once for all, respectfully to enter my protest against being dragged into the discussion of any such incidental topics. Let us have no skirmishing on the flanks — an opponent must, according to the Indian mode of expression, "stand in my path," who would prefer a claim to my attention.

I wish, in conclusion, to correct a mistake into which Mr. Frend has fallen, as to my meaning in one particular. How is it possible that he could have imagined, I referred to Dollond and his achromatic telescope, when I said, that "the most valuable method of determining the longitude, was at last accomplished by practical means, and by practical men?" I of course alluded principally to Harrison and his time-keeper.

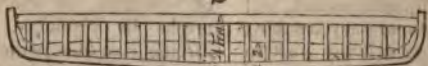
Yours, &c.

BENJ. CHEVERTON.

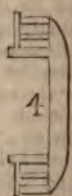
CHAIN FERRY-BOAT.

1

2



3



Sir,—In travelling through Sutherlandshire I was ferried across one of its rapid streams by means of a chain ferry-boat, lately placed there by the Duke of Sutherland, which, though on a principle common enough, seemed to me completer in its arrangements than any thing of the kind I ever before met with. The following descriptive details will probably be acceptable to your readers.

Fig. 1 is an external view of the boat as seen in operation; fig. 2 is a side view of the framing; fig. 3 a plan of the bottom framing; and fig. 4 an end view of the framing.

The greatest draught of the boat (at the centre) is not more than 14 inches; at the ends it is next to nothing.

The chain wheel *a* is 3 feet in diameter, with a shaft 2½ feet long, and 1½ inch in diameter: *t* is a pinion on

me shaft, 7 inches in diameter. y wheel *b* is 4 feet in diameter, is a shaft of the same length and ter as the chain wheel: *s* is a wheel on the same shaft. The handle is so adjusted as to take l on the spur wheel. A series of s and frames (*c c*), 10 inches in er, serve to keep the chain in the or rim of the wheel; *d d* are g rollers, 12 inches in length and iameter, with lifting rollers and 6 inches by 6; *e e* are rollers es long by 5 inches in diameter, sing and letting down the gang- vith a rope running on a pulley d to the top of the post; *f f* the ays; *g g* iron rods 1 inch in dia- which run through the gangway ; *k* is the capstan set in stone. whole expense of the boat, with aratus, did not, I am informed, 130*l*. The designs for it were ed by Mr. Alexander Coupar, gineer.

I am, Sir,

Your obedient servant,

R. Batson.

ess, June 23, 1834.

TRIP OF BURDEN'S STEAM-BOAT N FROM NEW YORK TO ALBANY.

(From the New York Gazette.)

Monday (the 7th July), Mr. Burden nied by only five or six friends, e had invited, and of whom we were ng the number, left the Dry Dock w steam-boat Helen, at six minutes ven A. M., reached the North River, the foot of Barclay-street, at ix minutes past seven. The Erie, e the fastest boat on the river, had dock twenty minutes before, and in sight six miles a head. The two oceeded on in gallant style, attract- erous persons along the wharves to the race. One remarkable feature novement of Burden's boat, which very one on board as an improve- a most important and highly novel , was the smoothness with which p pointed cylinders glided over or rough the water, like the sliding f a locomotive on a rail-road, caus- he slightest disturbance, and only a ple. There was nothing whatever iling up of the water on the bows, *sponding gush on the stern*; none *uctuation or swelling* on the river which all other steam-boats cause, and which is perceptibly seen as well as felt by the craft in their vicinity, and even by those along the docks and banks, though they may be a mile distant. We passed the handsome and swift little steam-boat Champion, after a tough contest, near Dobb's Ferry, at forty-six minutes past seven. We had not then attained more than sixteen or eighteen revolutions of our wheel per minute; nor was the steam fairly on, or twenty-two revolutions procured, till we neared Poughkeepsie, which we reached at twenty-two minutes past twelve. This is eighty miles, or half the distance from New York to Albany. We were now going at the rate of a mile in three minutes, or twenty miles an hour, and had come *within three miles* of the Erie. When we had every certainty of thus passing her in a very short time, the gear of the cut-off valve suddenly gave way at half-past one P. M., between Poughkeepsie and Lower Red Hook Landing, which immediately reduced our revolutions to sixteen, fourteen, and twelve.

At ten minutes before three P. M., finding our speed thus unhappily retarded by an unforeseen accident, we lay too and repaired, and got under weigh again at thirty-two minutes past three. But in ten minutes it broke again, and thus with every effort, and one of the boilers leaking as it had done the whole distance from New York, we found it utterly impossible to obtain more than sixteen and sometime eighteen revolutions. Nevertheless we resolutely pushed on in spite of every difficulty. We passed over the shallow water from Hudson upwards, and the *overslaugh*, with the same ease and facility we had the deepest channels. This we were enabled to do from the few inches of water we draw, a fact which of itself speaks volumes, and is unprecedented in the history of other steam-boats on this river.

And thus, notwithstanding the most unfavourable auspices we had to contend against, and it may be said *two and a half hours detention*, taking the retarded operations of the engine into the account, we reached Albany at six P. M., about *three quarters of an hour* after the Erie. This boat was prepared beforehand for the anticipated race, and had the advantage of her highly polished machinery by long use, and in the most perfect order; and she burned, we understand, large quantities of turpentine and tar to accelerate the generation of flame—heat. Our machinery had never been fairly put to trial before, and, therefore, the reflecting part of the community may judge of the immense friction which a new engine must create, to say nothing of the leakage and the accident. The Helen, therefore, performed her first trip to Albany.

in nine hours! Will she not, when in ample order, and when these difficulties are removed and subdued, make the passage in eight hours, if not less? We believe she will.

This experiment, therefore, cannot be deemed conclusive.

All along the river crowds manifested the deep interest they felt in our behalf, by cheering, waving flags, &c.; and at Catskill, Cocymans, and New London, cannon were fired from the docks in honour of our vessel.

There is not to be deducted more than ten or fifteen minutes from the Erie's time for the few stops she made. We witnessed ourselves, that at two or three places she was not detained two minutes at each.

(From the New York Mechanics' Magazine.)

Mr. Burden has since made another excursion from Troy to Hudson, and accomplished eighteen miles in sixty-five minutes. He is about building another boat, 100 feet longer than the present one, the parabolic spindles of which are to be of iron.

THE MATHEMATICAL CALCULATOR; OR TABLES OF LOGARITHMS OF NUMBERS, AND OF LOGARITHMIC SINES AND TANGENTS: WITH OTHER USEFUL TABLES; AND AN INTRODUCTION, THEORETICAL AND PRACTICAL. By ROBERT WALLACE. Glasgow, 1834. 24mo.

In this little work we have an addition to the list of portable Mathematical Tables, of which an account was given in our vol. xiv. p. 135. There is great resemblance between the present publication, and that of Barker, which it would have been fair in Mr. Wallace to have acknowledged; and although upon the whole the additional Tables contained in the present work entitle it to preference, yet there are some points to be set off on the opposite side, for instance, the want of the proportionate parts to the Log. of Nos., and the differences for each second to the Sines and Tangents. Nor are we by any means satisfied that the change which Mr. Wallace has made in the form of the last mentioned Tables is a judicious one. Those who adopt Mr. Wallace's volume as a pocket companion, using the larger Tables in their libraries, will certainly wish that the old established form had been preserved. The smaller Tables appended to the work are very convenient, but some of them might with propriety have been more exte and many others have been introc For instance, Natural Tangents Secants—Factors of Numbers— rithms of Fractions, whose denomi are under 100, and whose decimal are not limited by four places of fig Logarithms of the fraction $\frac{n}{372}$, fo puting interest for days—and, last extended Table of mathematical commercial Constants, and their rithms, to be collected from Bal Hutton (last edition), Galbraith, (Tab. Port. du Soleil), &c., no getting those in Mech. Mag. v. and vii. 59.

We have, in conclusion, to expre praise of the typography, which i tremely good.

BRIDGEWATER TREATISES: — ME NISM OF THE HAND.

The last Earl of Bridgewater, a eccentric nobleman, who died in left the magnificent sum of 8 for the composition and publicat a grand work, "On the power, wi and goodness, manifested in the tion." The testator's intention a to have been to attract the first li talent in the kingdom to the task, great amount of the premium o and thus to be instrumental in th duction of a standard classic, on ject of the very highest importance left the sum, however, at the disp the president of the Royal Society time being; and that gentleman Davies Gilbert), it appears, thoug end in view would be accomplish dividing the whole amount into portions, and paying over one th pounds to each of eight gentlemen should be appointed by himself, t duce a cut-and-dry essay on some fraction of the whole "high argu So that now, instead of being called to hail *one* most important and va standard addition to British lite as might have been the case ha 8,000*l.* been offered as a reward f best treatise which should be pro from "all England, in a specified —the public is presented with som or ten volumes of "shreds and pa duly furnished to order, by their

tive writers; each, no doubt, very good in its way, but still not exactly calculated to eclipse all predecessors, or to fulfil completely the intention of the noble testator.

Mr. Gilbert, it appears, was assisted in the selection of fit and proper authors of the proposed treatises, by the Archbishop of Canterbury and the Bishop of London; and, owing to some unexplained circumstance, no less than one-half of the whole number have been confided to the care of gentlemen of the clerical profession. The following is a list of the whole :—

The Adaptation of External Nature to the Moral and Intellectual Condition of Man. By the Rev. Dr. Chalmers.

The Adaptation of External Nature to the Physical Condition of Man. By Dr. Kidd.

Astronomy, and General Physics, considered with reference to Natural Theology. By the Rev. W. Whewell.

Animal and Vegetable Physiology. By Dr. Roget.

Geology and Mineralogy. By the Rev. Dr. Buckland.

The History, Habits, and Instincts of Animals. By the Rev. Mr. Kirby.

Chemistry, Meteorology, and the Functions of Digestion. By Dr. Prout.

And, The Hand, its Mechanism and Vital Endowments, as evincing design. By Sir Charles Bell, K. G. H., F. R. S., &c.*

It is to this latter work that we shall confine the present article, since we have scarcely space sufficient for even a brief notice of the rest, while the subject of this is more "germane" to the matter of a Mechanic's Magazine, than either of the other divisions.

The history of the volume is somewhat somewhat singular. Its substance, it appears, was delivered many years ago in the author's professional lectures, and had, moreover, been intended for publication in the form of notes and illustrations to the edition of Paley's Natural Theology, with which the public were to have been favoured by Sir Charles Bell, and a coadjutor no less distinguished than the Lord Chancellor. *That* idea has seemingly been entirely abandoned: his lordship has quite enough to do to keep the refractory peers in order, so that the wood-cuts he had had engraved for the purpose of embellishing his lucubrations, have (to save capital, we suppose,) long ago been worked into sundry volumes of the Library of Entertaining Knowledge:* — while Sir Charles, disappointed of the promised honours of co-editorship, consoles himself by re-arranging his old materials into the form of a treatise predestined to bring him in at least a thousand pounds! He seems to think it an additional recommendation, that his work has not been "got up" for the occasion;—but we hardly know whether the Earl of Bridgewater, were he alive, would be quite satisfied to have a second-hand production run away with his prize, or at least with a fair share of it. Be that as it may, however, it must be admitted that the circumstance of its not being written "according to sample," gives it an air of genuineness to the sentiments and opinions of the writer, which they might not otherwise so entirely possess;—and so far, so good.

From the introductory remarks, we shall quote a favourable specimen of Sir Charles's style of reasoning and expression :—

"There is inconsistency and something of the child's propensities still in mankind. A piece of mechanism, as a watch, a barometer, or a dial, will fix attention. A man will make journeys to see an engine stamp a coin or turn a block, yet the organs through which he has a thousand sources of enjoyment, and which are in themselves more exquisite in design and more curious both in contrivance and mechanism, do not enter his thoughts; and if he admire a living action, that admiration will probably be more excited by what is uncommon and monstrous, than what is neutral and perfectly adjusted to its office,—by the elephant's trunk than by the human hand. This does not arise from any unwillingness to contemplate the superiority or dignity of our own nature, nor from an incapacity of admiring the adaptation of parts. It is the effect of habit. The human hand is so beautifully formed, it has so fine a sensibility, that sensibility governs its notions so correctly, every effort of the will is an-

* *London, 1834. W. Pickering.* 8vo. pp. 348.

* Professor Rennie, who has quarrelled with his quondam employers, asserts this to be the fact.

swered so instantly, as if the hand itself were the very seat of that will; its actions are so powerful, so free, and yet so delicate, that it seems to possess a quality instinct in itself, and there is no thought of its complexity, as an instrument, or of the relations which make it subservient to the mind; we use it as we draw our breath, unconsciously, and have lost all recollection of the feeble and ill-directed efforts of its first exercise, by which it has been perfected. Is it not the very perfection of the instrument which makes us insensible to its use? A vulgar admiration is excited by seeing the spider-monkey pick up a straw or a piece of wood with its tail, or the elephant searching the keeper's pocket with his trunk. Now, fully to examine the peculiarity of the elephant's structure, that is to say, from its huge mass to deduce the necessity for its form, and from the form the necessity for its trunk, would lead us through a train of very curious observations to a more correct notion of that appendage, and therefore to a truer admiration of it. But I take this in contrast with the human hand, merely to show how insensible we are to the perfections of our own frame, and to the advantages attained through such a form. We use the limbs without being conscious, or, at least, without any conception of the thousand parts which must conform to a single act. To excite our attention we must either see the actions of the human frame performed in some mode strange and unexpected, such as may raise the wonder of the ignorant and vulgar, or by an effort of the cultivated mind we must rouse ourselves to observe things and actions of which, as we have said, the sense has been lost by long familiarity."—Page 14.

There may be nothing very novel in these observations, but they have at any rate truth and good sense to recommend them; and that is more than can be said of many an ambitious novelty.

Our author does not confine himself very closely to his subject, as defined in the title-page. On the contrary, he observes at once that he shall consider it in connexion with the whole system of Nature, and thus allow himself an ample field to expatiate in. The two sciences, however, which furnish by far the greatest share of matter are Geology and Comparative Anatomy, which appear to be such especial favourites with Sir Charles, that on them he can dilate *con amore*. This causes the work to assume an appearance of no very methodical arrangement, and to invest it with rather a discursive character: something of this may also be owing to the destination originally intended for the materials of which it is composed. The illustration of Paley would of course naturally embrace a much wider range than a treatise confined (professedly at least) to "the mechanism of the hand."

The following passage, in which a question of some interest is set at rest, will show with what ease our author can take a flight from one subject to another, in this instance from the hand and arm to the organs of speech:—

"Voltaire has said that Newton, with all his science, knew not how his arm moved! So true it is that all such studies have their limits; but, as he acknowledges, there is a wide difference between the ignorance of the child or of the peasant and the consciousness of the philosopher, that he has arrived at a point beyond which man's faculties do not carry him. We may add, is it nothing to have the mind awakened to the many proofs of design in the hand—to be brought to conviction that every thing is orderly and systematic in its structure,—that the most perfect mechanism, the most minute and curious apparatus, and sensibilities the most delicate and appropriate, are all combined in operation that we may move the hand? What the first impulse to motion is we do not know, nor how the mind is related to the body; yet it is important to know with what extraordinary contrivance and perfection of workmanship the bodily apparatus is placed between that internal faculty which impels us to use it and the exterior world.

"I have been asked by men of the first education and talents, whether any thing really deficient had been discovered in the organs of voice in the ourang-outang to prevent him from speaking? The reader will give me leave to place this matter correctly before him. In speaking, there is first required a certain force of expired air, or an action of the whole muscles of respiration; in the second place, the vocal chords in the top of the wind-pipe must be drawn into accordance by their muscles, else no vibration will take place and no sound issue; thirdly, the open passages of the throat must be expanded, contracted, or extended by their numerous muscles, in correspondence with the condition of the vocal chords or glottis, and these must all sympathize before even a simple sound is produced; but to articulate that sound, so that it may become a part of conventional language, there must be added an action of the pharynx, of the palate, of the tongue and lips. The exquisite organisation for all this is not visible in the organs of the voice, as they are called; it is to be found in

the nerves which combine all these various parts into one simultaneous act. The meshes of the spider's web, or the cordage of a man-of-war, are few and simple, compared with the connected filaments of nerves which move these parts, and if but one be wanting, or its tone or action disturbed in the slightest degree, every body knows how a man will stand with his mouth open, twisting his tongue and lips in vain attempts to utter a word.

"It will now appear that there must be distinct lines of association suited to the organs of voice—different to combine them in the bark of a dog, in the neighing of a horse, or in the shrill whistle of the ape. That there are wide distinctions in the structure of the different classes of animals is most certain; but, independently of those which are apparent, there are secret and minute varieties in the associating cords. The ape, therefore, does not articulate:—First, because the organs are not perfect to this end: secondly, because the nerves do not associate these organs in that variety of action which is necessary to speech. And, lastly, were all the exterior apparatus perfect, there is no impulse to that act of speaking.

"Now, I hope it appears from this enumeration of parts that the main differences in the internal faculty or propensity. As soon as a child can distinguish and admire, then are its features in action; its voice begins to be modified into a variety of sounds; these are taken up and repeated by the nurse, and already a sort of convention is established between them. The perfect correspondence is a contrivance, but the source of articulation, that which prompts to the first efforts, is in our intellectual nature. We cannot therefore doubt that a propensity is created in correspondence with the outward organs, without which they would be useless appendages. The aptness of the instrument or external organ will undoubtedly improve the faculty, just as we find that giving freedom to the expression of passion adds force to the emotion in the mind."—Page 236.

On the whole, the work must be allowed, however ingenious, to be deficient in arrangement. It brings together a vast multitude of facts, of the most curious and important character, but "the thread that ties them" is far looser than it needs to be. A sufficient proof of this is to be found in the mass of "Additional Illustration," which are given in a detached form at the end of the volume, having been added too late, we suppose, to allow of their being interwoven in the *body of the work.* This is a mark of either haste or carelessness which ought not to have appeared in a book written under circumstances so much more favourable than is generally the case. It is paying but a poor compliment to the munificence of its patron, and the expectations of the public.

We have often had occasion to question the outcry at the "decline of science in England,"—an outcry which, the more its justice is inquired into, redounds the more to the discredit of those who raise it. It has been heretofore shown, that it must have originated only in the egregious ignorance of the "declinarians" as to what had been done by men of science in their own country, and within their own especial sphere; and now Sir Charles Bell adds the weight of his testimony on the same side. After giving an explanation of his own discoveries in that branch of Physiology in which we owe so much to his researches, Sir Charles goes on to observe—(and with his observations we shall conclude):—

"The views of the nervous system, which are shortly given in the text, guided me in my original experiment twenty-two years ago. They have been attributed to foreign physiologists. The ignorance of what has been done in England may be, for strangers, an excuse for maintaining these opinions as their own; but the authors at home, who should have known what has been taught in this country, are inexcusable, when they countenance these assumptions."—Page 173.

THE PHENOMENA OF FLAME AND MR. JOHN MURRAY'S CLAIMS.

Dear Sir,—I am one of the very last who would deny to Mr. John Murray (Mec. Mag. 576, p. 347,) his just claims to priority in any matter, be it ever so trifling, or ever so important. It seems, however, that Mr. M. is morbidly sensitive about the due acknowledgment of these claims, not only by those who are supposed to have been fully acquainted with them, but by those also who have never previously heard of them. The complaint of this gentleman is of so extensive and sweeping a character, that I shall only advert to circumstances in which I am personally interested; and this I should not have done, had he not

mentioned me by name in his letter to you, inserted as above, and also in his public lectures.

Mr. Murray will doubtless concede to others that which I dare say he claims for himself, and which is the inalienable right of every one, namely, the right of thinking, and reasoning, and examining. To a man who is accustomed to make a proper use of the faculties with which God has endowed him, who mixes much in society, and who is, from habit, as well as inclination, constantly investigating causes and effects. I can imagine nothing more difficult than that he should be able to separate, the one from the other, those ideas which congregate in his own mind, and those whose germinating principle may have been fixed there by a communication from another.

Knowledge is diffusive. As well may we attempt to turn back the sun in his course, or to erect flood-gates across the Atlantic, as to stay the progress of knowledge. From Mr. Murray's position in society as an author, and with a well-earned reputation as a public lecturer in one of the most interesting departments of experimental philosophy. He must necessarily enjoy no ordinary advantages, both for acquiring and for dispensing information on scientific subjects. Why does he now turn aside from the legitimate and ennobling objects of his profession, to dispute a point of precedence which ought to have been settled sixteen years ago? or why does he imagine, that every one who dares to think about the theory of flame and combustion, has consulted his paper in the "Philosophical Magazine" of 1816?

That Mr. Murray is entitled to a *divided*, if not a *prior* claim—for having illustrated the true nature of flame, as respects its form—is undoubted. But when we remember the many years that have elapsed since his paper was published, and the absence of all allusion to it in the most popular works published since that time, it is no wonder that many, by the operation of a later chronology, or some other circumstances, should remain ignorant of his opinions.

That favouritism prevails to a fearful extent in the scientific world, and that a great name is often substituted for good *sense, it would be vain to deny.* But *the humble pioneers* in science are not very likely to incur this change. To their honour, it generally happens, that they value truth wherever it may be found, irrespectively of name or station. Let not Mr. Murray hastily conclude, that every one who may happen to hold views similar to his own, has been ploughing with his heifer!

As far I am myself concerned, I can assure Mr. Murray that it is only *very lately* I have seen his pamphlet on "Flame and Safety Lamps." Previous to my purchasing that pamphlet, I had never heard of his paper in the "Philosophical Magazine" of 1816. In a communication to the Mech. Mag., No. 569, p. 229, I have already stated my obligations to F. H., and to Mr. Watson, for kindly putting me in possession of the papers of Sym and Davies; which papers, as well as Mr. Murray's pamphlet, I had never seen. Nor was I in any way acquainted with the views contained in them, until *many months* after I had satisfied myself that flame is not that which it is described to be by Sir Humphrey Davy.

Now, as respects what Mr. Murray is pleased to term Mr. Rutter's affair, it may be some satisfaction to that gentleman to be informed that my affair had been rather more than four months publicly in operation, as a heating process, at the gas-works here, and also those at Salisbury, before I became acquainted with Mr. Money's tar-and-water-burners. Ms. Money's name was first presented to my notice in the Mechanics' Magazine, Oct. 26, 1833. The following Saturday there appeared a description of his apparatus, which was communicated by Mr. Weeks, inventor of the "Universal Portable Eudiometer."

The experiment of Mr. Murray at the Surrey Institution, which that gentleman very incorrectly assumes to have been "the basis of all this," and which he states to have been described in the "Journal of Science and Art" for 1818, I know nothing about. I have never seen any description of it; nor did I become acquainted with the fact until I read it in the pamphlet "on Flame and Safety Lamps."

At the time I was engaged in the experiments on the combustion of coal-tar, which led inductively to the use of water in conjunction with that material, I had

never heard, nor read, nor seen, any thing that related, in the most remote degree, to the use of water or steam as an auxiliary to fuel. The whole amount of my knowledge at that time (Nov. 1832) on the combustion of tar, was its being used as fuel in many gas-works—not as a measure of economy, but as one means of getting rid of an intolerable nuisance—and that it was a wasteful, filthy, offensive process. This character the combustion of tar at first fully sustained under my own hands. One nuisance was removed which gave birth to another. The odour of the tar was detected by its imperfect combustion, more than half a mile to leeward of the works. Whatever disputes may arise as to the principle of the process which I have now successfully employed during the last eighteen months, they will never affect its practical utility. The combustion of coal-tar, instead of being a filthy, wasteful, and uncertain method for heating gas retorts, is now, if it be properly conducted, a clean, economical, and effective process, accompanied neither by smoke nor any other offensive effluvium. Since this process has been made public, I have heard of what has been done by some other persons; but whilst the principle may have been nearly the same, the application has been different. In no one instance, until my own plan was announced, have I ascertained that water has been beneficially and economically employed as fuel. When we consider the comparatively few and simple principles by whose operation the ordinations of nature are sustained, it would be strange indeed, if any man, during the brief hours of earthy existence, whatever his talents or opportunities should do that, the like of which had never been thought of, attempted, nor done, in a different way, by his predecessors or his cotemporaries. The annals of philosophy abound with instances of cotemporaneous invention and discovery; and there are, doubtless, thousands of others, the remembrance of which have perished because they were not recorded. But does priority of publication, in the order of time (I am not alluding to any legal technicality), constitute the only claim to originality? It may now be impossible to decide the question of priority; but I suppose Mr. Murray considers himself fully entitled to the character of an *original* experimentalist, with respect to flame. Now, it is certain, the late Mr. Sym was at work, at, or about, the same time, and in the same field with Mr. Murray; although these gentlemen were unperceived by each other. Mr. Murray's paper on flame was published, it seems, on the last day of one month, Mr. Sym's on the first day of the succeeding month.*

It is greatly to be desired that less of an exclusive, and more of a benevolent, spirit, should be exhibited by those who occupy the higher walks of science. Mr. Murray, by his long standing in the scientific world, has a right to expect that his opinions should be received with deference, especially when they are supported by experimental demonstration. The charge of neglect attaches, however, to those who take upon themselves the office of furnishing authentic information to the public; but who wilfully, negligently, or ignorantly, mislead and misinform their readers.

Man is not the inventor of principles. They are as immutable and as imperishable as the throne of the MOST HIGH. To man it is given—by patient research—by rigid examination—by laborious thought—by skilful manipulation—to unveil the mysterious relations that exist among the elements of matter, and that determine the varied phenomena which surround us. Let us all pursue this delightful employment in the spirit of true philosophy, not stopping to find fault, but rather encouraging each other; and accounting our labour as not altogether in vain, if we can each add one FACT to those which are already well attested.

Dear Sir,
I am your faithful,
J. O. N. RUTTER.

August 25, 1834.

THE WHISTON UNDULATING RAILWAY.

My dear Sir,—I am again under the necessity of addressing you in explanation of a further delay, which has occurred, in the trial of our experiments on the Whiston branch line. On applying to the Directors of the Liverpool and Manchester Railway, for the use of one of their suitable locomotive engines, I

* They may be said to have been literally published on the same day; for those monthly journals which are dated on the first day of each month are always published on the day preceding.

was sorry to find that we could not be accommodated. Their carriages and the road were at our service; but the locomotive engine could not conveniently be spared.

Under these circumstances, we had no other resource than to endeavour to provide an engine elsewhere, either on loan or hire, and I am now anxiously awaiting answers to my inquiries on the subject.

Our intention is to try a series of careful experiments on the earliest possible day, the result of which I will send you, and immediately afterwards to appoint a more public day of trial, which shall be duly announced.

The railway was entirely completed on Monday last, and I had an opportunity of witnessing such very satisfactory proofs of the advantageous effects of gravity in longitudinal conveyance or undulations, as to even strengthen, if possible, the opinions I had previously formed. I will not, however, at present, enter into particulars, which I intend should form a part of my next communication.

I am, dear Sir, very truly,

RICHARD BADNALL.

Farm Hill, near Douglas, Isle of Man,
Aug. 25, 1834.

CANALS IN THE STATE OF NEW YORK.

Erie Canal.—Length from Lake Erie to the Hudson River, 363 miles, viz.—

Western section—Buffalo to Montezuma, on Seneca River. 157 miles, 21 locks, fall 186 feet. Middle section—Montezuma to Utica, 96 miles, 11 rise and fall, 95 feet. Eastern section—Utica to Albany, 110 miles, 52 fall, 417 feet.—Total, 363 miles, 84 rise and fall, 698 feet.

Lake Erie is 565 feet above the Hudson River at Albany.

The canal is forty feet wide on the surface, and four feet deep.

Champlain Canal.—This canal commences at the junction with the Erie canal, nine miles north of Albany, and terminates at Whitehall, in the county of Washington, connecting the waters of the Erie canal and the Hudson river with Lake Champlain. It has a lateral cut connecting it with the Hudson River by three locks at Waterford, eleven miles north of Albany, as the Erie Canal has connecting it with the same river at West Troy, by two locks.

Length from Lake Champlain, at Whitehall, to junction with Erie Canal, nine miles above Albany, sixty-three miles. Number of locks, as follows:—

Seven locks rise from the lake to the summit level, 54 feet. Fourteen locks fall from the summit level to the Hudson, 134 feet.—Total, 21 locks; Rise and fall, 188 feet.

Oswego Canal.—Length from Salina to Oswego, thirty-eight miles; connecting Lake Ontario with the Erie Canal. One half the distance is canal, and one half slack water, or river navigation, with a towing path on the bank. Fourteen locks, (thirteen of stone, and one of wood and stone.) Descent from Salina to Lake Ontario, 123 feet.

Cayuga and Seneca Canal.—Commences at the Erie Canal at Montezuma, Cayuga county, and terminates at Geneva, Ontario county, connecting the waters of the Erie Canal with those of Seneca Lake. This canal has also a lateral branch to East Cayuga village, on the Cayuga Lake, thus connecting with the waters of that lake. It opens a lake navigation of more than 100 miles.

Length twenty miles and forty-four chains, from Geneva, on the Seneca Lake, to Montezuma on the Erie Canal. One half canal, and one half slack water navigation. Two thousand seven hundred and ten feet of towpath bridges. Eleven wood locks. Descent, seventy-three and a half feet from Seneca Lake to the Erie Canal at Montezuma.

Chemung Canal.—Extends from the head waters of the Seneca Lake to the Chemung (or Uioga) River, a branch of the Susquehannah, at the village of Elmira, Tioga county. Length twenty-two and a half miles, with a navigable feeder from Painted Post, Stuben county, on the Chemung River, to the summit level, thirteen and a half miles, making thirty-six miles of canal navigation. This canal thus forms part of a chain of communication from the Erie Canal to the Susquehannah River. It has fifty-two wood locks, comprising five hundred and sixteen feet of lockage, and one guard lock, three aqueducts, five culverts, and seventy-six bridges. Distance from Elmira to Albany, via this canal, Seneca Lake, Cayuga and Seneca and Erie Canals, three hundred and twenty-six miles.

Crooked Lake Canal.—Extends from Penn Yan to Dresden, both in Yates county, connecting the waters of the Crooked and Seneca Lakes, through a beautiful and fertile country. It is eight miles in length, and has two hundred and sixty feet of lockage, which is overcome by twenty-seven wood locks. The other structures are one guard lock, twelve bridges, three culverts, and one waste weir.

SUMMARY OF CANALS COMPLETED.

	Length:	Cost.	Tolls, 1833.
;anal . . .	363 miles	9,027,456 05	1,290,136 20
plain, ditto . .	63 do.	1,179,871 75	132,559 02
;o, ditto . . .	38 do.	565,437 35	22,950 47
;a and Seneca, ditto .	20 do.	236,804 74	17,174 69
ung, ditto, and feeder .	36 do.	342,133 95	694 00
ed Lake Canal . .	8 do.	136,331 95	200 84
able feeders on Erie, Cham- n, and Cayuga, and Seneca ıals . .	11 do.	11,488,035 99	1,463,715 22 dollars.

Total, 539 miles of canal navigation, completed and owned by ate. Average cost per mile 21,314 dollars.—*Franklin Journal.*

T OF NEW PATENTS, GRANTED BETWEEN THE 22D OF JULY AND THE 24TH OF AUGUST, 1834.

Twisden, of Halberton, near Tiverton, com- r in the Royal Navy, for improvements ap- e to inland navigation. July 24; six months ify.

iam Hale of Colchester, civil engineer, for improvements in or on windmills, which ements are applicable to other purposes. ; six months to specify.

iam Coles, of Charing Cross, Esq., for a cer- ecific or remedy for the cure, alleviation, or tion of rheumatic, gouty, or other affections from colds or other causes. July 26; six to specify.

:e Barthelemy Guinibert Debac, of Acre- rixton, Professor of languages and mathe- , for an improved machine for weighing, e means of keeping a register of the opera- f the instrument. July 26; six months to .

Chanter of Stamford-street, Blackfriars, and William Witty, of Basford-cottage, near stle, Staffordshire, engineer, for an improved l or improved methods of abstracting heat team and other vapours and fluids, appli- stills, breweries, and other useful purposes. ; six months to specify.

nas John Hamilton, Earl of Orkney, and laster, engineer, both of Taplow, Bucks, for improvements in machinery or apparatus pelling vessels and water. July 26; six to specify,

und Youldon, of Exmouth, schoolmaster, rovements in preventing or curing what are smokey chimneys. August 5; two months ify.

uel Wellman Wright, of Sloane Terrace, a, engineer, for certain improvements in iery or apparatus for refrigerating fluids. ; six months to specify.

nas Gaunt of Bridport-place Hoxton, Gent., improvement in earthen-ware pans or basins er-closets, and certain other earthenware , to which such improvement is applicable. 2; six months to specify.

rew Hall, of Manchester, manufacturer, and Stark, the younger, of Chortten-upon-Med- utter out, for improvements in the construc- ' *looms for weaving by hand or power.* ; *six months to specify.*

James Ward, of Stratford-upon-Avon, watch-maker, for improvements in apparatus for venti-lating buildings and other places. Aug. 12; six months to specify.

Charles Arter, of Havant, county of Southamp-ton, plumber and glasier, for certain improvements on cocks and taps for drawing off liquids. Aug. 12; six months to specify.

James Pedder, of New Radford, machinist, for certain improvements applicable to certain machi-nery for making bobbin-net lace, for the purpose of making ornamented bobbin-net lace, by the ap-plication to such machinery of any or all of the said improvements. Aug. 13; six months to specify.

William Bruce, of Edinburgh, baker, for im-provements in machinery or apparatus for making ship and other biscuit or bread, being a communi-cation from a foreigner abroad. Aug. 14; six months to specify.

Jacob Perkins, of Fleet-street, London, engi-neer, for improvements in the apparatus and means for producing ice, and in cooling fluids. Aug. 14; six months to specify.

Thomas de la Rue, of Finsbury-place, Middlesex, fancy stationer, for an improvement or improve-ments in manufacturing or preparing embossed paper hangings. Aug. 15; six months to specify.

John Keith Norman Thomson, of Holland-street, Blackfriars, cork manufacturer, for certain im-provements in machinery for cutting or making corks and bungs. Aug. 23; six months to specify.

John Rapson, of Penryn, engineer, for an im-proved apparatus for facilitating the steering of vessels of certain descriptions. Aug. 23; four months to specify.

Robert Stein, of Walcot-place, Lambeth, Esq., for certain improvements in certain engines to be worked by steam. Aug. 23; six months to specify.

George Child, of Brixton, Gent., for an improve-ment or improvements in machinery for raising water and other liquids, being a communication from a foreigner residing abroad.. Aug. 23; six months to specify.

Webster Flockton, of Horsleydown, Southwark, turpentine distiller, for an improvement in manu-facturing rosin. Aug. 23; six months to specify.

James Slater of Salford, bleacher, for certain improvements in addition to certain improved ma-chinery for bleaching linen and cotton goods. Aug. 23; six months to specify.

NOTES AND NOTICES.

Among the varieties of timber trees discovered by the settlers in Southern Africa, is one used by the missionaries for the manufacture of household furniture, of a saffron colour, and called "sneeze wood," from the effect of its pungent scent when newly cut, and which, among other good properties, is said to possess that of repelling all noxious vermin from its neighbourhood. It is singular enough that some of the Canadian timber imported into this country has a directly contrary effect.

Mr. Toplis, of the Museum of National Manufactures in Liecester-square, has constructed an engine, which he calls the Pacificator, because, according to his views, it will render armed multitudes powerless against any people disposed to defend themselves—a score of men, with this auxiliary power, being competent to annihilate the largest army which could be collected. The engine is portable, and, without its casing, might be carried by two men; mounted upon its proper carriage, it can be moved with celerity into any situation where horses or men can go; it is ready for action in a moment, and can be made at will to pour out for any desired time a continuous stream of bullets, which can be directed towards any point or object, with the same facility as the stream of water from a fire-engine, and with perfect precision; whilst the men who direct it are sheltered in entire security. Its construction is exceedingly simple:—a long tube like the barrel of a rifle, is mounted on a swivel. The breech of this barrel communicates with a chamber, in which gas is rapidly evolved by the combustion of gunpowder, so prepared that it burns without exploding. This gas rushes through the barrel, and propels the bullets, which drop into the barrel through a funnel, from a reservoir placed above it. The barrel can be elevated or depressed, or turned in any direction, with the utmost ease, so that the men who work it can discharge, with unerring aim, a stream of bullets that must destroy every thing exposed to it.—*Morning Chronicle.*

Aerial Steam-boat.—One of our ingenious citizens, Mr. Mason, has invented, and has now in preparation, the model of an aerial steam-boat, in which he proposes to ascend. The boat is about 10 feet long, the ribs being covered with silk, in order to render it very light. The engine, of two horse power, is placed in the middle, and turns four vertical shafts projecting over the *bow* and *stern*, into each of which are fixed four spiral silken wings, which are made to revolve with sufficient velocity to cause the vessel to rise. Over the whole is fixed a moveable silken cover, designed to assist in counteracting the gravitating force, at the same time tending to assist in its propulsion forward. The whole boat, including the engine, weighs 60 lbs., and has cost about 300 dollars.—*Cincinnati Daily Gazette.*

Experiments have been made with luggage trains down the inclined plane at Sutton, on the Liverpool and Manchester railway, to ascertain the distance the trains would move without the aid of engines. Some of the heavy trains acquired such a velocity in descending the incline as to run a mile (?) on the level without the aid of power.—*Manchester Chronicle, Aug.* 23.

Improved Method of Tuning Piano-fortes.—Among the recent new inventions announced in Paris is an improved method of tuning pianos, which is so simple that a person with a tolerable *ear may tune* the instrument himself. This is effected by means of a piece of mechanism formed of *pressure screws*, so that the large tuning key will be no longer wanted, and be superseded by one small enough to go into a lady's work-box; and it is formed on such a principle that the tone may be ascertained with the greatest nicety, and no risk of breaking the strings is incurred.—*Athenæum.*

A correspondent advises Mr. Hancock that he might probably do better, if, instead of manfully contending against all obstacles to locomotive progress, he were to abandon the enterprise in disgust, and to employ his time, before the next session of Parliament, in preparing matters for getting up a Committee of the Commons to bolster up his claims to a national reward for his past endeavours. Mr. Gurney can furnish him with instructions in what manner he should proceed.

Neglected Water-power.—Near the Lake of Mountcashel, in the county Clare, within a few miles of the great commercial town of Limerick, there is a magnificent water-power in the fall of the river Ougarnee. Yet it is of very little more value than the noise made by its fall. A source of treasure, if judiciously applied, is now only used for turning the wheel of an insignificant mill.—*From an Irish Correspondent.*

We lament to see, in the Irish newspapers, an account of a pleasure boat having been upset on Lough Strangford, by which four gentlemen were drowned, including among the number our highly-gifted and much respected correspondent Φ. μ. He perished in the prime of life, and in the midst of a career which promised to be one of more than ordinary brilliancy. Passionately fond of scientific pursuits, he brought to them qualifications of the very highest order—a mind of much natural energy, well disciplined by education, and richly stored with various learning—habits of most patient, untiring research—great tact in analysis, combined (rare combination!) with equal tact in generalization—singular readiness and fertility of invention—and a love of truth, which dictated the same uniform and scrupulous respect for the claims of others, which he demanded—always modestly, yet firmly, for his own.—He did our work the honour of making it the medium of a great many ingenious suggestions and speculations; but we have reason to think, that they formed but a small, and by no means the most important, portion of his philosophical labours. If his papers have fallen into good hands—which we sincerely trust they have—we make no doubt that we shall, ere long, hear more of them, and of their accomplished but ill-fated author.

Meteorological Stone.—A Finland journal gives an account of a singular stone in the north of Finland, where it answers the purpose of a public barometer. On the approach of rain, this stone assumes a black or dark grey colour, and when the weather is inclined to be fair, it is covered all over with white specks. This stone is, in all probability, an argillous rock, containing a portion of rock salt, ammonia, or saltpetre, and absorbing more or less humidity in proportion as the atmosphere is more or less charged with it. In the latter case, the saline particles, becoming crystalized, are visible to the eye as white specks.

Communications received from N. G.—Mr. Clark—Mr. Woodhouse—Mr. Tree—F. P. S.

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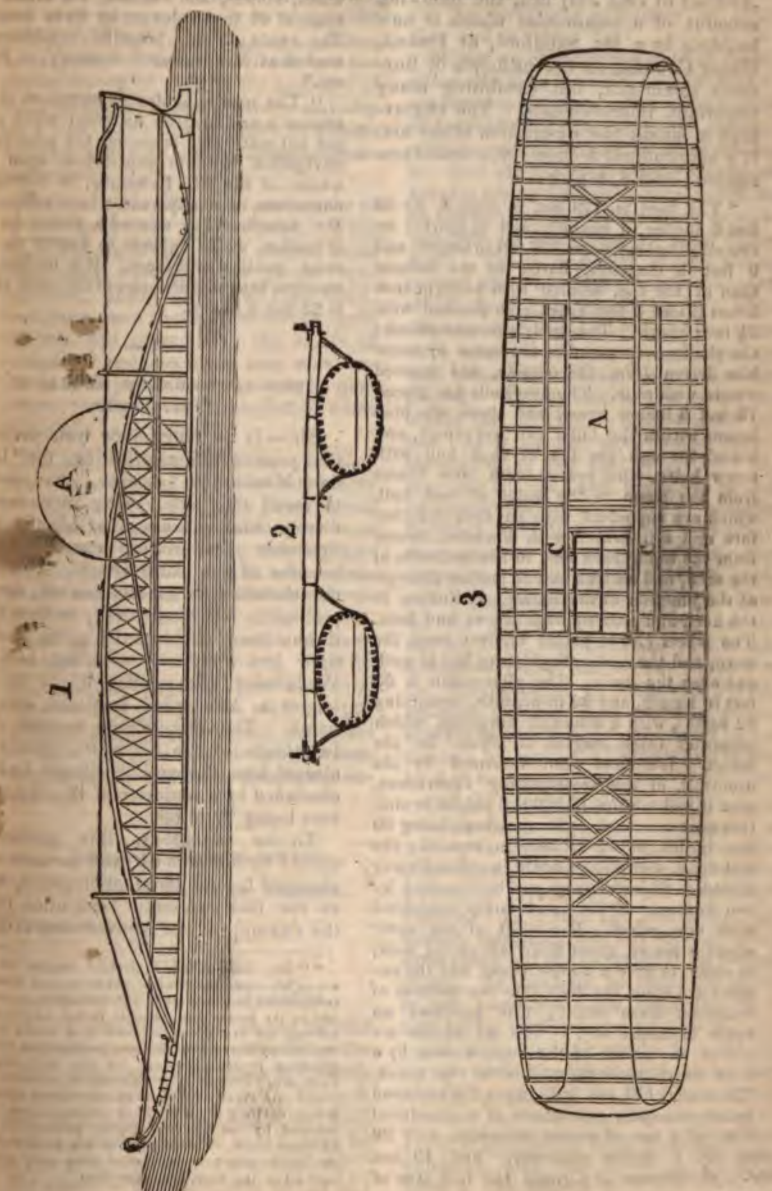
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 578. SATURDAY, SEPTEMBER 6, 1834. Price 3*d*.

CANADIAN TWIN STEAM-BOAT.



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the outside of the boiler. The whole length of the boiler is 19 feet. They are placed forward of the wheel, side by side, so that one smoke-pipe serves for both. The engines (C C) are outside the boilers; and the wheel, boilers, and engines, are within the space of 46 feet in length by 20 in breadth. The whole of this beautiful machinery is worked at Mr. Hulbert's foundery, at Prescott.*

"The most sanguine expectations of her success is anticipated: an event which cannot fail materially to change the principle of navigation hitherto subservient upon the waters of the St. Lawrence, to difficulties dangerous, and apparently insurmountable. Mr. Sandford has secured a patent for his invention, which appears to justify the utmost public confidence. We omitted to mention that the diameter of the water wheel is 25 feet 6 inches."

THE LATE LONDON MECHANICS' INSTITUTION.

Sir.—It is long since you declared that your rebellious offspring, the "London Mechanics' Institute," had ceased to merit that title, being in no respect distinguishable from other Literary and Scientific Institutions, except by the lowness of the subscription. You will not, therefore, be greatly grieved, though perhaps a little surprised, to learn that it has been declared by a resolution of their last quarterly meeting, held on Wednesday, September 3, to be no longer a *Mechanics'* Institute, even in name. The law which enacted that two-thirds of the committee should be elected from the working-classes *has been abolished* by a majority of 12—the numbers being 77 to 65.

To be consistent, this proceeding should be followed up, and the *name* also changed for one more appropriate, such as the Birkbeckonian Institution (after the example of the Andersonian at Glas-

* "Mr. Hulbert has a circular engine, for the use of his foundery, which makes several thousand revolutions in a minute. The machinery is simple, and by its power the several lathes employed in moving the brass, copper, and iron works of the machinery are set in motion, besides the various grinding stones necessary for the sharpening of tools &c. The beam of this engine resembles the shape of a cigar, and is of extraordinary strength, being entirely composed of wrought iron, untouched by the file, but highly polished by the hammer alone. The number of machines engaged in the foundery alone varies from forty to fifty, and all of the most scientific class."

gow), or still better, perhaps, the Clerks' College, the majority of members consisting of law and mercantile clerks.

I do not, under existing circumstances, blame the members for this last step they have taken; it is only what should have been done long ago. Since the majority of the subscribers are not mechanics—why should the majority of the committee be so? Every majority has a right to sway the affairs of a community—and why not at Southampton-buildings?

The upshot is, that the mechanics of London have now no institution. That which was theirs has been wrested from them—that which, under proper management, might have been their boast, their glory, and the inheritance of their children, has passed into the hands of strangers; and *mechanics* may now return to their pot-houses, and their gin-palaces, to drown the "thoughts of what they *might* have been."

It is not of course to be expected that you, Mr. Editor, can feel otherwise upon this subject, than as a parent upon the loss of a reprobate child. Nor is it to be expected that, after the ingratitude you have met with, you will again use any endeavours to establish a *bona-fide* Mechanics' Institute. The mechanics of London, if they wish to keep pace with those of other towns, must do this for themselves; and there are none more fitting to commence such an undertaking than the few *real mechanics* who have, from almost the commencement, been members at Southampton-buildings.

I am, Sir,

Your most obedient servant,

A SECEDED MEMBER.

Islington, Sept. 4, 1834.

CHILDREN CHIMNEY-SWEEPERS.

Sir,—I attended very closely on the Committee of the House of Lords on the Chimney-sweepers' Regulation Bill, which has since passed into an act. The evidence there given is now before me, and, I think, presents matter which may be useful and interesting to your readers.

The object of the promoters of the bill was to prevent the employment of children for the purpose of cleansing chimneys and flues; and, for human beings, to substitute machinery. They did not accomplish all they desired: it remains for the public to effectuate the object they had in view.

When we consider the state of the sciences and arts, it would be monstrous if we could not clear a tube, of the shape and dimensions of an ordinary chimney, without passing a human body through it. And yet the great majority of housekeepers are either altogether indifferent on the subject, or believe there is no reliance to be placed on any other instrument. To be sure, the *things* we see carried about by some chimney-sweepers, which they call machines, but which they certainly display with a view to induce housekeepers *not* to use them, are well calculated to keep the children employed. Many chimney-sweepers are afraid lest machinery should come into use. If it should, they must work it themselves, or pay men to work it; *now* they can sit idle, and leave the work to be performed by their infant servants. But they will tell you that, at all events, there must be climbing boys, for coring chimneys, for detecting flaws in them, and for repairing those flaws. Now, for the proper understanding of this matter, I will beg the reader just to take a sheet of paper, and to cut it down to the dimensions of 14 inches by 9,—the ordinary dimensions of our chimneys,—though there are many, which are passed through by boys, not exceeding 9 inches by 9 ("bare nines," as they are called),—and then let him judge whether it be possible for a boy, in such a space, to take up a lighted candle, examine the chimney, and then use brick, mortar, and trowel, to repair it. I am persuaded, from all I have seen and heard, that, generally speaking, the boy cannot fairly even brush out the chimney from bottom to top. In climbing, he holds the brush in one hand above his head, the other arm being confined straight by the opposite side; and he works himself up partly with his knees and back, but mainly by placing the brush across the chimney and drawing himself up by it. There is generally a strong draught in the chimney, and the child is obliged to keep a cap drawn over his face, to pre-

vent the soot getting into his eyes, ears, mouth, and nostrils. All the cleansing that takes place in the chimney is from the rubbing of his body and rags against the interior of it; but as to repairing, I believe it never is done with any certainty by him. Supposing the child to be able to sweep the chimney, we cannot rely on his doing it. He may be idle, he may have too many chimneys to attend to within a given time, his master may be dishonest, and may teach him to be dishonest too. My belief is, that the chimney-sweeper is called in much oftener than would be needed, if the cleansing were efficiently performed. But as to the machine, rude as it yet is, when it is fairly used (and the housekeeper can always see whether it is or not) it accomplishes its object—of *cleansing*, at least. And in case of fire in the chimney, it may be run up at once to sweep the ignited soot down; but the boy must wait till the chimney is cool enough for his reception.

In addressing the editor of a publication devoted to science and the arts, I have thought it right first to call attention to the field for invention and improvement in chimney-cleansing by machinery. Having done so, I will not, for the present, further trespass on your columns. I shall, however, offer you, in future letters, some of the substance and spirit of the evidence taken on this subject. I am, Sir,

Your obedient servant,
ARCHIBALD ROSSER.

15, New Boswell-court,
Sept. 3, 1834.

A NEW MINISTER OF STATE'S OPINIONS OF THE INFLUENCE OF KNOWLEDGE.

Sir,—I beg to solicit a place in your pages, for an extract on that still much disputed question, the influence of knowledge, from a speech delivered at the Mechanics' Institution of this city, three or four years ago, by one of the heads of his Majesty's present Administration. You are not to suppose, however, that I do so invidiously. I am not aware of any thing that Mr. Spring Rice has individually said or done, which would warrant me in assuming that the possession of office has *in the least blunted* his anxiety for the enlightenment of the people. I send you this extract, simply because of the excellence of the sentiments which it contains, and from a persuasion that you will take pleasure in assisting to make them as universally known as they deserve to be.

I remain, Sir,
Your constant reader,
And obedient servant,
FERGUS FITZFERGUS.

Limerick, August 9, 1834.

"Gentlemen, we live in an age of wonders, in which the inventive and productive powers of man render new industry and exertion day by day more requisite. All mankind around us appear moving onward in a rapid race of improvement, and if we do not advance, we shall be left disgracefully in the rear—if we do not advance, we must retrograde; and in doing so, we not only lose our chance of improvement, but we forfeit whatever of advantage we now enjoy. There is no stability in the present affairs of man; but with knowledge and good principle the movement that is taking place must be all for good. In trade and manufactures, we see daily the expense of production diminished, and the quantity of all the comforts and necessaries of life almost indefinitely increased. To some of the parties engaged in industry, this may for a time be, and must necessarily appear, an evil; but when it is viewed on more general principles, common sense must reject the fallacy, that general abundance and general cheapness can be other than blessings. *The greatest happiness of the greatest number* has been quaintly defined to be the end of all government, and that will ever be best attained by the entire freedom of human industry, and the removal of restraints from trade. Let our institute, therefore, teach us that free trade is not an instrument of mischief, as has been suggested by interest or prejudice; but, as it may be defined, a permission to all mankind to produce all articles of industry without restraint, and to interchange that produce without difficulty, it is a contradiction in terms to imagine that such a system can be any other than a benefit. The trustees of a turnpike may feel jealous of the proprietors of a canal—the rail-road may supersede the latter—steam-navigation on our noble river may supersede cars and carriages along the shores; but is it not clear that in all these operations the community at large is benefited? Having referred to these matters of civil engineering, I should be culpable indeed if I were not to advert to the zeal, public spirit, and science displayed by an honourable gentleman present, Mr. Steele,

who has most honourably devoted the energies of his powerful mind to the improvement of our river navigation.* In this manner he has acquired himself real claims on the respect and gratitude of his countrymen, as a contributor to what is really practical and useful in that science to which he has applied himself.

"One word and I conclude. Our object is knowledge—good and pleasurable in itself, and in its consequences immediate and remote. A wise man has said knowledge is power; it is so, it teaches how to control and direct the physical agencies around us, and make them obedient to our will, and instruments of our intelligence. The elements around us can thus be rendered subservient to our wants, necessities and enjoyments. But this is not all, knowledge is happiness—it creates about us, from the materials with which Providence has blest us, either by our own invention or our combinations, new sources of physical comfort, and it developes all that is characteristic of a civilised social system. *Further, knowledge, well understood, is not only power and happiness, but virtue.* It leads us forward to moral excellence, it teaches us to subdue selfishness, to consider the interests of our fellow-men, as well as our own, to look to futurity as well as the present. It reads the best lesson of moral instruction, and it finally impresses on our morality the awful sanctions of religion. Pursuing this brilliant course, the performance of duties here, leads us to the hope of immortality hereafter."

* We extract from the *Limerick Chronicle* the following interesting notice of the first lighting up of the Tarbert Rock Light-house, which, as our readers are aware, has been erected chiefly through Mr. Steele's instrumentality:—"The lantern on the beautiful tower, built by the Ballast Board on the Tarbert Rock, was lighted for the first time on Monday evening, and its splendid illumination was hailed with joy by all the mariners in the Shannon, and every one connected with the navigation of the river. About midnight Mr. Steele arrived in a boat at the rock, that he might examine the interior of the light house. He had crossed from Labasheeda Bay, in the west of the county Clare, and had been rowing about for some hours observing the effect from the water. After minutely inspecting every part of the building, he opened a bottle of wine in the lantern, and he, and the pilots, and sailors, and boatmen who attended him, drank it to the health of his friend Mr. Halpin, the engineer of the Ballast Board of Dublin, of whom he spoke in terms of the warmest gratitude, for the manner in which he had carried his plan of erecting a light-house at this point into practical execution. The arrangements of every part of the structure, he said, commanded his admiration. The illumination was splendid, the ventilation admirable, the building beautifully designed and beautifully executed, and nothing which he could possibly desire had been omitted. Mr. Steele then declared his intention of making immediate application to the Ballast Board for another *lantern on the beacon tower on the Beeves, which, if granted, would be an improvement of inestimable value.*"

IMPROVEMENT IN CHIMNEY-FLUES.

Sir,—The following sketches represent a mode of constructing the chimney flues of a dwelling-house, so that they may be all swept—whether by boys or machines—from the basement story, and the present inconvenient and dirty practice of entering the different rooms for the purpose be completely superseded.

Fig. 1 is a section of a stack of chimneys thus constructed. The different flues, it will be observed, all communicate with each other, but there are dampers between them, for the purpose of cutting off or opening the communication at pleasure. These dampers may be either of iron or copper, but the latter is the better material, if used of sufficient thickness to resist the heat.

Fig. 2 is a section on an enlarged scale, through the flues at A B of fig. 1, showing more particularly the form of the dampers, and how they operate; C C are the doors; D D, the frames; E E, two bars with a space between them for the sweep or machine to pass through. Each damper turns on hinges at the bottom, and is made fast at top to the frame (which it must fit closely) by means of a strong bolt. When the chimney of a room is to be swept, the bolt of the damper is withdrawn, on which it falls forward; shutting off the communication with the room, while it gives access to the sweep or machine, from above or below. The small portion of the chimney below the damper may be afterwards swept by a servant with a hand brush.

Fig. 3 is a transverse section of fig. 2.

As the jambs of the chimneys on the ground floor, and the bed-room floor next the attic, will be thus necessarily rendered unequal, the elevation, fig. 4, shows how this defect may be concealed. By bringing forward the part marked F, this will form a small projection, and give to the jambs the appearance of being exactly alike.

Fig. 5 is a ground plan of fig. 4.

Trusting you will consider this improvement deserving a place in your valuable pages,

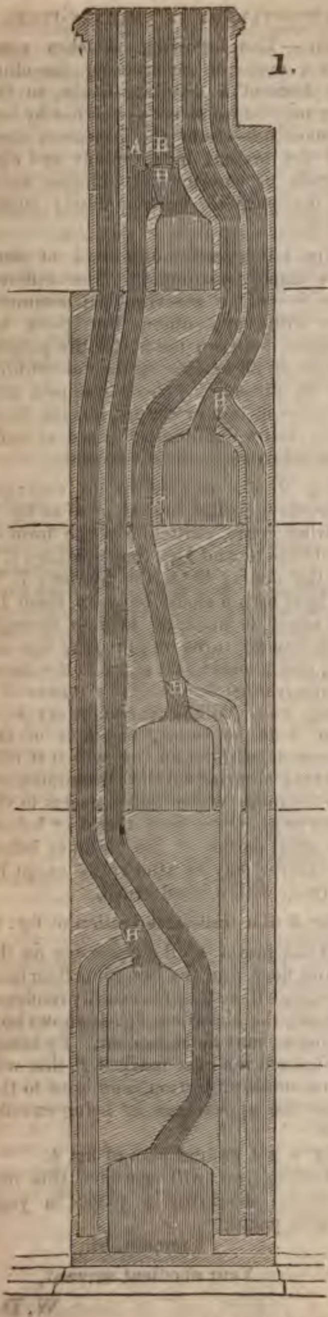
I remain, Sir,

Your obedient servant,

W. D.

Norwood, July, 1834.

1.



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3.

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INCONVENIENCE OF CHANGES IN WEIGHTS AND MEASURES.

(From Report of Professor Renwick, of Columbia College, to the Commissioners for Revising the Laws of the State of New York.)

At the breaking out of the Revolution in France, the steps necessary to form a system of weights and measures entirely different from those formerly existing, and resting not merely for their standards, but for their absolute units, upon a measure deduced from a constant dimension in nature, were undertaken. The result of this investigation was in a system that, if tested by the facility of applying to it the principles of decimal arithmetic, by the scientific and practical skill of the parties employed in the task, or by the great zeal and intelligence shown by them, is deserving of all praise. But in spite of the favourable circumstances existing at that era, when the whole nation was searching after novelties, and no prejudice in favour of any ancient customs could be considered as opposing, it was found that it could not be introduced in its full extent; and that the part on which the proposers most prided themselves, namely, the decimal division, by which it became accommodated to the existing scale of arithmetic magnitude, was the first which required modification. On the 12th of March, 1812, previous to the downfal of the Emperor Napoleon, the ancient denominations of lineal dimension, toise, foot, inch, &c., were restored, but appropriated to measures derived from the metrical system; and since the restoration of the Bourbons, that system has been further modified by the application of the ancient name of pound to the half kilogramme, with which that weight nearly corresponds. Nor does the necessity of making these changes arise from the inveteracy of prejudices, from which the French nation might be considered at the time as almost entirely free, but from causes actually existing in nature. The decimal notation, although long use has made it habitual, is by no means the most convenient for the calculations of arithmetic; it seems to have originated in no other cause than the habit of counting upon the fingers in the infancy of society; and although, from established habit, it would be proper in the ascending scale of weights and measures in ordinary use, and in the descending scale in scientific inquiry, is not applicable to the divisions of the unit in traffic. For this last purpose, a system admitting of *binary* division is alone fitted; and with this the *duo*-decimal division of the foot is sufficiently agreeable; while it is found in the full extent in the customary *divisions of the yard, the* avoirdupois pound *and the bushel.*

The terms foot, yard, pound, &c., are, in fact, identified with our language; and it would be as easy to subvert the form and dialect of our ordinary colloquial speech, as to introduce new standards of weight and measure with new names. All that can reasonably be attempted, is to refer the units of the several denominations to some measure in nature, constant, determinate, and easily determinable, making such slight changes, not appreciable in the transactions of trade, as will tend to the facility of this determination; and, in addition, the means by which the accuracy of existing standards may be tested in future times, or the standards themselves restored, if lost, must be defined. To do more is to attempt what is wholly beyond the reach of legislative power.

MR. BABBAGE AND HIS CALCULATING ENGINE.

Many unfounded rumours have obtained circulation as to the course adopted by Government in this undertaking, and as to the position in which Mr. Babbage stands with respect to it. We shall state, upon authority on which the most perfect reliance may be placed, what have been the actual circumstances of the arrangement which has been made, and of the steps which have been already taken.

Being advised that the objects of the projected machinery were of paramount importance to a maritime country, and that, from its nature, it could never be undertaken with advantage by any individual as a pecuniary speculation, Government determined to engage Mr. Babbage to construct the calculating engine for the nation. It was then thought that the work could be completed in two or three years, and it was accordingly undertaken on this understanding about the year 1821, and since then has been in progress. The execution of the workmanship was confided to an engineer, by whom all the subordinate workmen were employed, and who supplied for the work all the requisite tools and other machinery; the latter being his own property, and not that of the Government. This engineer furnished, at intervals, his accounts, which were duly audited by proper persons, appointed for that purpose. It was thought advisable, with a view, perhaps, to invest Mr. Babbage with more strict authority over the subordinate agents, that the payment of these accounts of the engineer should pass through his hands. The amount was accordingly, from time to time, issued to him by the Treasury, and paid over to the engineer. This circumstance has given rise to reports that he

has received considerable sums of money as a remuneration for his skill and labour in inventing and constructing this machinery. Such reports are altogether destitute of truth. He has received, neither directly nor indirectly, any remuneration whatever; on the contrary, owing to various official delays in the issues of money for the payment of the engineer, he has frequently been obliged to advance these payments himself, that the work might proceed without interruption. Had he not been enabled to do this from his private resources, it would have been impossible that the machinery could have arrived at its present advanced state.

It will be a matter of regret to every friend of science to learn that, notwithstanding such assistance, the progress of the work has been suspended, and the workmen dismissed, for more than a year and a half; nor does there, at the present moment, appear to be any immediate prospect of its being resumed. What the causes may be of a suspension so extraordinary, of a project of such great national and universal interest, in which the country has already invested a sum of such serious amount as 15,000*l*.—is a question which will at once suggest itself to every mind; and is one to which, notwithstanding frequent inquiries in quarters from which correct information might be expected, we have not been able to obtain any satisfactory answer. It is not true, we are assured, that Government object to make the necessary payments, or even advances, to carry on the work. It is not true, we are also assured, that any practical difficulty has arisen in the construction of the mechanism; on the contrary, the drawings of all the parts of it are completed, and may be inspected by any person appointed on the part of Government to examine them. Mr. Babbage is known as a man of unwearied activity and aspiring ambition. Why, then, it may be asked, is it that he, seeing his present reputation and future fame depending in so great a degree on the successful issue of this undertaking, has, nevertheless, allowed it to stand still for so long a period, without distinctly pointing out to Government the course which they should adopt to remove the causes of delay? Had he done this (which we consider to be equally due to the nation and to himself), he would have thrown upon Government and its agents the whole responsibility for the delay, and consequent loss; but we believe he has not done so. On the contrary it is said that he has of late almost withdrawn from all interference on the subject, either with the Government or with the engineer. Does not Mr. Babbage *perceive the inference* which the world will *draw from this course of* conduct? Does he *not see that they will* impute it to a distrust in his own power to complete what he has begun? We feel assured that such is not the case, and we are anxious, equally for the sake of science and for Mr. Babbage's own reputation, that the mystery—for such it must be regarded—should be cleared up; and that all obstructions to the progress of the undertaking should be immediately removed. Does this supineness and apparent indifference, so incompatible with the known character of Mr. Babbage, arise from any feeling of dissatisfaction at the existing arrangements between himself and the Government? If such be the actual cause of the delay (and we believe that in some degree it is so), we cannot refrain from expressing our surprise that he does not adopt the candid and straightforward course of declaring the grounds of his discontent, and explaining the arrangement he desires to be adopted. We do not hesitate to say that every reasonable accommodation and assistance ought to be afforded to him. But if he will pertinaciously abstain from this, to our minds, obvious and proper course, then it is surely the duty of Government to appoint proper persons to inquire into and report upon the present state of the machinery; to ascertain the causes of its suspension; and to recommend such measures as may appear to be most effectual to ensure its speedy completion. If they do not by such means succeed in putting the project in a state of advancement, they will at least shift from themselves all responsibility for its suspension.—*Edinburgh Review, No. 120, which contains by far the fullest and most intelligible description of the engine in question which has yet appeared.*

BUILDING AND BRICK-MAKING.

We noticed with approbation, in our Journal of May 14, 1831, two brick-making machines, which were patented about that time by Mr. S. R. Bakewell, formerly of the United States, but now of Manchester—one of them being for preparing the brick earth, and the other for consolidating the bricks when cast. Mr. Bakewell claims to be the first person that ever made a fire brick west of the Alleghany Mountains, capable of sustaining the heat of an air furnace; and, unless he over-rates his pretensions greatly—which we by no means think he does—he is also the destined instrument of some equally important improvements in the brick-making of our own country. In a rambling but clever

little pamphlet,* which he has just published, on the general subject of "Building and Brick-making," and on the merits of his own inventions in particular, he observes of the state of these arts in England:—

"That brick-making in England has been until lately the most imperfect of all the mechanical arts, I presume no one who has paid the least attention to the subject will attempt to deny; should he do so, let him examine without prejudice the fronts of the buildings throughout the kingdom, and he will find that two-thirds at least are constructed of rough, ugly, soft, mis-shapen lumps of burnt clay (hardly deserving the name of bricks), full of hollows, fissures, and protuberances, and will absorb water like a sponge; consequently houses built of such materials (to say nothing of their want of beauty and durability), cannot fail of being damp and unhealthy at all seasons of the year. Such bricks are a disgrace to the manufacturers, and in some measure to the inhabitants who purchase them for not rejecting such trash, or allowing the makers a more liberal price to enable them to make better. The principal defect (next to bad firing) is in the tempering of the clay, which operation ought to be performed more than double what is usual, because the quality of the bricks in a great measure depends on that important operation. I am credibly informed that there is a statute still unrepealed, though obsolete, which was enacted at the particular recommendation of James I., which required (under a heavy penalty) that no bricks should be made unless the clay had been exposed to the weather, and turned over *at intervals* three times at least before the 1st of March. And a wise regulation it was, not only on account of the great improvement it would make in the bricks, but because it gave employment to a great number of workmen at an inclement season of the year, when it might be difficult to obtain other occupations. Bricks made of such clay would unquestionably be much more *solid* and *durable* than those made at present; and each one (the size being the same) would contain about one-sixth more clay than if tempered in the imperfect manner it is at present. But this is not altogether the fault of the manufacturer, but of the unwise custom of letting jobs by contract to the lowest bidder, who is often compelled, to save himself from loss, to purchase the worst articles he can meet with, provided they are cheap."—pp. 13, 14.

Again:—

"There appears to me greater inconsistency in the gentlemen of England generally (although not universally), as respects the construction of their houses, than at first view may be admitted. In almost every thing else external appearance is every thing; but in house building this rule seems to be reversed: whilst the most extravagant expense is lavished on the inside of a house, but little attention appears to be paid to the excellence or beauty of the outside. The only apology that can be advanced in behalf of this palpable deficiency in taste, has been the difficulty, hitherto, of obtaining good as well as handsome bricks; for even stocks, or such as are dressed or polished by hand in the usual manner, are often more injured than benefited by that operation, for there is scarcely one in twenty but what are more or less put out of shape thereby. In the cities of Washington, Baltimore, and Philadelphia, for some years back, scarcely a house has been erected the front bricks of which have not cost at least 3*l.* 10*s.*, and principally 4*l.* 10*s.* to 5*l.* per 1,000; although in that country they pay no duty, and the liberal price above mentioned is paid cheerfully and without reluctance. However, candour induces me to acknowledge that the gentlemen before alluded to, who construct houses for the purpose of residing in themselves, cannot be charged with parsimony, and scarcely with economy, otherwise the *artificial, temporary* and *expensive* practice of daubing over their fronts with mortar (fashionably styled stucco), would not so generally prevail; and although it must be acknowledged that houses of this description look handsome for a while, yet, comparatively, in a short time they become mean and shabby in the extreme, and require to be almost continually patched or repaired, and, even when most perfect, we know it to be a deception, and intended to hide deformity and worthlessness; and the defects above mentioned can be only partially amended by incurring the enormous expense of periodical painting at short intervals."—pp. 17, 18.

Of London more particularly:—

"The clay in and near London is at present, and has been for some time, of a very ordinary quality. Mr. Lees, an eminent builder, accidentally discovered some years ago that by mixing powdered chalk amongst it, the colour, as well as the quality of the bricks were considerably improved; he patented his invention, and what is not more strange than true, his patent had run seven years before he was enabled to dispose of a single license to others. This information I received from an authority which may be

* Observations on Building and Brick-making; to which are subjoined Extracts from Testimonials in behalf of S. R. Bakewell's Patent Brick-making Machines. Manchester, 1834.

relied upon; and it serves to prove how exceedingly slow and averse people generally are to adopt new inventions, and it does not speak much in favour of the enterprise or judgment of the brick-makers (at that period) of the first city in the world. * * * * * Before this digression, I was observing that by the admixture of chalk with the earth, of which the bricks are made in and near London, they are considerably improved; nevertheless, from the uncertain mode of firing there practised, together with mixing coal-ashes with the other materials (which is consumed in burning), they are left very porous, and a great portion of them will of course absorb water abundantly, consequently they are *far inferior* in quality to those that are made in many other parts of England; yet they have one mode of managing their bricks in my opinion superior to the general custom of the country, and that is of placing them in walls to dry directly after they are moulded, instead of laying them singly on floors exposed to heavy rains. This practice necessity compels them to adopt, because if their bricks were exposed to one-fifth of the heavy rains that fall (without much injuring *common* ones) on those made in Manchester, they would be entirely spoiled; nevertheless, I think it a very good plan, and might be introduced to advantage by those who have plenty of room, for which I will give my reasons:—1st, The bricks would be seldom, if ever, injured by rain; and, 2dly, as they are obliged to be carried away on wheelbarrows, the moulders would be compelled to use stiffer clay than they commonly do at present, of course the bricks would be so much the better; and although the moulders of *common* bricks in London are better workmen generally than those either of Manchester or Liverpool, yet they are inferior to those of many other places, and as to fine or polished bricks *they make none*: nevertheless, the practical workmen in that city generally, but more especially the foremen, are so insufferably prejudiced and conceited that they are quite disgusting, and fancy themselves to be the best brick-makers in the world, although it is very probable they were never beyond the sound of Bow bells. It may not be generally known in the country, that yellow is the favourite colour of bricks in London, and the nearer they approach to that of brimstone the more perfect they are considered. I minutely examined some which were the remains of the old White Conduit House, and there can be few doubts that they were manufactured several centuries ago, and they were as yellow as the best *that are made* at this period; therefore the *earth of which they* were formed must naturally *have possessed* a larger portion of chalk than what is commonly found in the clay at present, because Mr. Lees' discovery could not possibly have been lost, after being once known."—pp. 5, 6.

We regret to say, there is but too much truth in all this. Mr. Bakewell, however, is rather hard on the poor brick-makers. He seems not to be aware how much another class of makers have had to do in the matter—we mean our *law-makers*. We recommend to his attentive consideration the following pertinent observations on this head, extracted from Mr. Montgomery Martin's "Taxation of the British Empire:"—

"We now come to inquire what is the effect on bricks of the excise laws, and we find in this as in every other instance, '*the trail of the serpent is over them all.*' By the 17 Geo. III. c. 42, bricks made for sale in England must be 8½ inches long, 2½ inches thick, and four wide; the size of the sieves for sifting coal-ashes to mix with the clay, must not exceed a quarter an inch between the meshes; the reader, however, will see most clearly the onerous nature of the laws governing this simple branch of rural employment, in the following admirable paragraph from the *Spectator*:—

"'Notice must be given of the intention to begin *making*, under the penalty of 100*l.* The size, the form, and, it may be said, the quality of the article, is prescribed, and the size of the sieve is fixed. The articles are chargeable with the duty (subject to an allowance of 10 in the 100 for waste) directly as they come from the mould. From the nature of the manufacture, this is, however, insufficient, and the same raw material may have to pay the duty several successive times. For as all the processes take place in the open air, the article is liable to be injured, or even destroyed, by heat, by cold, or by rain; and, when a batch has successfully escaped the elements, there is still the ordeal of the kiln. Thus, when the bricks, on leaving the mould, are *set up*, they may be destroyed by frost in a single night. After re-working and re-paying, they may be washed away, or otherwise damaged, by a storm or land flood. If the material, or any part of it, is again re-worked, the duty is again levied, and the bricks are placed in *clamp*; where they may, from accident, turn out *shaky*, or be altogether spoiled. For natural risks, the consumers of a manufacture must, of course, pay; but, in the present case, the premium of insurance is very greatly raised by the tax, whilst the risk itself is very greatly increased by the regulations. For instance, when the bricks are once *set up*, there they must remain till the officer has

'brought them to charge,' or what is virtually the same, has given permission to remove them, although their non-removal should subject them to be injured or destroyed. Every spot where they are placed during the process of a manufacture must be *entered*. If, from accident, carelessness, or design, they are put in an *unentered* place, the maker is subjected to a penalty of 50*l*. After all, the duty only yields 365,000*l*., from which there is to be deducted the expense of the collection. This is very considerable, for brick-fields are scattered all over the country, and frequently established for a temporary purpose,—as when houses are to be erected in a remote neighbourhood, or when brick-earth is found upon the intended site, and the builder turns brick-maker for the nonce.'"—pp. 109, 110.

Mr. Bakewell thinks that the best clay for bricks in England is that of Colebrookdale; and the best bricks those manufactured at Manchester, and at Newton Solney, near Burton-upon-Trent:—

"I have found the clay in various parts of England very good, particularly near Leicester, Derby, Manchester, and Liverpool, in others much inferior, although for *common* bricks, in the two places last named, they are very bad temperers; but the very best clay for red bricks that I have ever met with in the whole course of my life in any country, is that which is found in the vicinity of Colebrookdale. It is raised in a similar manner to coal, from a considerable depth in the earth, and if *pressed* bricks made of this clay could be conveyed at a reasonable rate to Liverpool, and from thence, as ballast, to the city of New York (at which place they import from Baltimore, Philadelphia, &c., all their *front* bricks), I would insure that almost any quantity might be sold at from five and a half to six guineas per thousand, if not more."—pp. 6, 7.

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"I cannot well conclude without bearing my impartial testimony in favour of the principal brick-burners in Manchester, and acknowledge that (with one exception only, and even in that case they are not surpassed) they are the very best at that department of the business I have ever met with in any country. The person alluded to above as equal to them is Mr. Hopkins, of Newton Solney, near Burton-upon-Trent, who, take him in every branch of the business, was, until the newly-invented brick-presses were introduced, the very best brick-maker *in England: of this* I have not the shadow of a doubt; but then he has a much superior method to any brick-maker in Manchester of tempering his clay (although an expensive one); and he is enabled to take more time both in moulding and dressing his bricks, from never selling any for fronts under 3*l*. 10*s*. per thousand."—p. 16.

Now for Mr. Bakewell's own improvements—the principle of which he candidly admits was suggested to him by "an Englishman," whose name, however, he forgets to mention:—

"I have visited within a short period the principal brick-yards in about twenty counties in England, and also those in eighteen of the States of North America, and I verily believe that I have seen more than a dozen different machines for, and modes of tempering clay; and it is my candid opinion, that a clay-mill on the very best principle that has ever been in use (both as to *quality* and *quantity*) was invented by an Englishman, the manager of an extensive brick-yard belonging to the late Benjamin Morgan, Esq., an eminent merchant of New Orleans; they are universally adopted in that city, and about fifty of them are almost constantly in operation; and mills on this principle, combined with various valuable improvements which I have added lately, are those which I have patented in England. I can take clay dry from the bank from whence it has been dug, sufficient for 16,000 bricks; allow it to soak in the mill all night, and, with the aid of two horses and a boy, on the following morning, in three hours it will be well and completely tempered, and *much better* than by any other plan or contrivance that I have ever either seen or heard of. Not a lump as large as a pea can be found amongst it; and it will be as smooth, tough, and ductile as can be desired; and I have not the shadow of a doubt but that these mills would save the brick makers in and near London at least 2*s*. per thousand on all the common bricks they make, and double that amount on those in which they mix chalk; and as the clay would be infinitely better tempered than it is, the quality of the bricks would also be *greatly* improved; yet from the apparent disposition of both principals and foremen, there appears but a very slight prospect of my being able to introduce them into that part of the kingdom."—pp. 14, 15.

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"The brick-*presses* before alluded to are those which I have patented, and by means of which bricks are now manufactured more beautiful than can be conceived without ocular demonstration: suffice it to observe that they are as square and smooth as a die,

and as solid as a block of marble, as each brick when in a half-dried state receives a pressure of more than two tons. The machines in which the operation of pressing is performed are so simple and solid (yet extremely powerful), that I defy their greatest enemies to put them out of order (unless intentionally); and any novice who has never made a brick may learn to work them to advantage in fifteen minutes. And as to their durability, they will, I should suppose, by occasionally giving a new lining to the mould, the expense of which will be a mere trifle, last from twenty to twenty-five years." —pp. 16, 17.

"These bricks have also another important advantage over those that are manufactured at present—the faces of each being indented or countersunk, about a quarter of an inch deep, and within an inch of their edges, enables the workmen to make the joints *as small as possible*, and the surplus mortar that enters the internal cavities forms a key or dowel in the walls; buildings constructed of such bricks will not require iron rods attached to those ugly protuberances—wall plates, to hold or bind them together, neither will housebreakers be able to make openings through walls built of such materials, by first picking out the mortar and thereby loosening the bricks, after which they are easily taken out. Occurrences have frequently happened in Manchester and in many other places in the kingdom; but on this plan it will be impossible for them to accomplish their ends without *breaking the bricks in pieces*, which would make so much noise that could not fail of alarming the neighbourhood."—p. 18.

"If such bricks are properly burnt, a front of them cannot fail being extremely beautiful; and as to their durability no correct calculation can be made, but there can be but few doubts but that they will remain good, and retain their *excellence*, if not their *present* beauty, longer than stone. I am induced to adopt this conclusion from the fact, that bricks have, within these few years, been brought from the ruins of Babylon, and it is believed from the temple of Belus, to the city of New York, that were as sound and good as when first made—nearly 3,000 years ago; and what is very singular, these bricks had each several letters or hieroglyphics impressed upon them, which must have been done before they were burnt; and there is now to be seen any day at Leicester, near St. Nicholas's church, a quantity of red tiles, about an inch and a half in thickness, and of such two or more arches are formed; and it is generally believed by antiquarians that they are a part of the temple of Janus, which temple historians inform us was closed at the period of the birth of our Saviour, in conformity to the custom of the Romans, as to the temples dedicated to that deity in periods of universal peace: consequently these tiles must be nearly, if not more than 2,000 years old, and yet they are of a bright red colour, and apparently as fresh and sound as if they had not been laid a year. Query—Is there any stone with which we are acquainted that will bear exposure to the atmosphere *half* as long without mouldering?"—p. 19.

We gather from the "Testimonials," appended to Mr. Bakewell's pamphlet, that his pressing-machines have come into partial use in Manchester, Nottingham, Leicester, and several other provincial towns. We hope—indeed we have no doubt—that we shall ere long see them universally adopted; and that the opposition which he complains of having hitherto encountered from our metropolitan "principals and foremen," will speedily give way to juster and more liberal views.

DEATH OF MR. TELFORD.

We announce, with feelings of deep regret, the death of this eminent and excellent individual, which took place at five o'clock on Tuesday afternoon last, at his house in Abingdon-street.

Mr. Telford was in the 79th year of his age. The immediate cause of his death was a repetition of severe bilious attacks, to which he had for some years been subject. He was a native of Langholm, in Dumfries-shire, which he left at an early age. His gradual rise from the stone-masons' and builders' yard to the top of his profession, in his own country, or, we believe we may say, in the world, is to be ascribed not more to his genius, his consummate ability, and persevering industry, than to his plain, honest, straightforward dealing, and the integrity and candour which marked his character throughout life.

Mr. Telford had been for some time past by degrees retiring from professional business, to enable him the better to "adjust his mantle." He has of late chiefly employed his time in writing a detailed account of the principal works which he planned, and lived to see executed; and it is a singular and fortunate circumstance that the corrected manuscript of this work was only completed by his clerk, under his direction, two or three days ago. His works are so numerous all over the island, that there is hardly a

county in England, Wales, or Scotland, in which they may not be pointed out. The Menai and Conway bridges, the Caledonian canal, the St. Katharine's Docks, the Holyhead roads and bridges, the Highland roads and bridges, the Chirke and Pont-y-cisilte aqueducts, the canals in Salop, and great works in that county, of which he was surveyor for more than half a century, are some of the traits of his genius which occur to us, and which will immortalise the name of Thomas Telford.

We have access to know that he was inclined to set a higher value on the success which has attended his exertions for improving the great communication from London to Holyhead, the alterations of the line of road, its smoothness, and the excellence of the bridges, than on the success of any other work he executed; but it seems difficult to draw a line of distinction with any thing like nicety of discrimination, as to the degree of credit to which an engineer is entitled for ingenuity to plan, and the ability to execute, magnificent and public improvements on the public communications of a great country. The Menai-bridge will probably be regarded by the public as the most imperishable monument of Mr. Telford's fame. This bridge over the Bangor-ferry, connecting the counties of Carnarvon and Anglesea, partly of stone and partly of iron, on the suspension principle, consists of seven stone arches, exceeding in magnitude every work of the kind in the world. They connect the land with the two main piers, which rise 53 feet above the level of the road, over the top of which the chains are suspended, each chain being 1,714 feet from the fastenings in the rock. The first three-masted vessel passed under the bridge in 1826. Her topmasts were nearly as high as a frigate; but they cleared 12 feet and a half below the centre of the roadway. The suspending power of the chains was calculated at 2,016 tons; the total weight of each chain, 121 tons.

The Caledonian canal is another of Mr. Telford's splendid works; in constructing every part of which, though prodigious difficulties were to be surmounted, he was successful. But the individuals in high station now travelling in the most remote part of the island, from Inverness to Dunrobin Castle, or from thence to Thurso, the most distant town in the north of Scotland, will there, if we are not mistaken, find proofs of the exertion of Mr. Telford's professional talent, equal to any that appear in any other quarter of Britain. The road from Inverness to the county of Sutherland, and through Caithness, made, not only so far as respects its construction, but its direction, under Mr. Telford's orders, is superior in point of line and smoothness to any part of the road of equal continuous length between London and Inverness. This is a remarkable fact, which, from the great difficulties he had to overcome in passing through a rugged, hilly, and mountainous district, incontrovertibly establishes his great skill in the engineering department, as well as in the construction of great public communications.

These great and useful works do not, however, more entitle the name of Telford to the gratitude of his country, than his sterling worth in private life. His easiness of access, and the playfulness of his disposition, even to the close of life, endear his memory to his many private friends.—*Courier*.

The following eloquent tribute to the merits of Mr. Telford's great work, the Menai Bridge, appeared some years ago in the Dedication to Mr. T. Steele's "Practical Suggestions on the Improvement of the Shannon:" — "On the evening when I took my seat as an associate member of the Institution of Civil Engineers, I signed in your presence a declaration that I would always, to the utmost of my power, endeavour to promote the objects for which the society had been founded; and I now, without at all identifying you with my politics, beg permission to dedicate to you the following pages; and at the same time when I make an humble effort to fulfil my pledge to the institution, I may, as an Irishman, have the gratification of publicly expressing my sense of the benefit you have conferred on my country, by increasing to the extent that you have increased it, the rapidity of the communication between Ireland and England. In the progress of your work, sir, for drawing the two countries by so many hours nearer to each other than they were before, you have not only formed one of the most magnificent roads in the world over the mountains of Wales, but you have suspended in the midway air—not over a river, but over a portion of the mighty deep itself—a monument to your genius, harmonising with the objects around, beneath, and on high; for, like the ridge of the Cambrian mountains, the ocean-tide, and the firmament of Heaven,

> 'This new wondrous Pontalice unhoped.'
>
> MILTON.

The bridge over the billows of the Menai is sublime."

It is not, we believe, generally known that Mr. Telford was a poet as well as engineer. In early life, he was the "Eskdale Tam" of the poetical corner of the Scots Magazine; and on the death of Burns he wrote some very beautiful verses to his memory, which are published in Dr. Currie's Life of the Ayrshire bard. On reading them one is tempted to say (with a slight alteration), as Pope did of Mansfield,—

> "How sweet a Ramsay was in Telford lost!"

CALICO PRINTING.

[Extracts from Minutes of Evidence before the Select Committee of the House of Commons, on Manufactures, Commerce, and Shipping.]

Mr. James Thomson, calico-printer, at Primrose, near Clithero, examined (14th and 18th June, 1833):

What is your opinion of the present state of the print trade?—My opinion is that it is now, and has been for the last eighteen months, in a much more prosperous state than during any other portion of the last six years. There is a more steady demand, and fair remunerating prices; there is better employment for all the persons engaged in it.

Has the removal of the duty been attended with considerable advantage to the trade?—I think it has with very great advantage.

Do you consider that that advantage is to be measured only by the amount of the duty repealed, or are there any other collateral advantages which have arisen from the removal of that duty? In the first place, it gives to the consumer the article from 30 to 40 per cent. cheaper than it could be had before; for instance, a very useful and respectable dress can be had for half-a-crown, for a poor woman, which would have cost nearly 4*s*. before the repeal of the duty. I consider that the advantage to the consumer is not merely the amount of the duty, but it goes even beyond that, for the manufacturer has been greatly benefited by the repeal in other respects. The competition between the fraudulent manufacturer and the honest one, which was very injurious, and which, it appears, greatly exceeded what we ourselves suspected, is now done away. The advantage of being freed, in a manufacture requiring great skill, and often possessing important secrets, from daily and hourly supervision, is important, for it is well known that many improvements have been carried off from the manufactories by the officers. There is also the advantage of being perfectly master of your own apparatus. We can print now at any hour that we receive the order; whereas before we were obliged to wait for the arrival of the officer to measure the cloth; and we can pack our goods the moment they are ready, without being obliged to wait till they have stamped them, an operation that was attended with extreme inconvenience and delay; in fact, we wonder now how we have supported the chain that we wore so long. There is also another advantage: needy persons very often bought printed calicoes, and exported them in order to raise a capital by the drawback. These were sent to markets often to which they were quite unsuited; and there again arose very ruinous competition with the honest merchant; goods sent unfit for the market, and obliged to be sacrificed, affecting very grievously the price of other goods; so that, altogether, we consider the advantage arising from the repeal of the duty to be very considerable.

Do you apprehend, in the trade in which you are engaged, much from foreign competition?—The competition is gaining ground, but it is not formidable at present.

Are you acquainted with the nature and extent of that competition?—In France I have taken great pains to make myself acquainted with it. In the year 1824, I spent some months there, and I am only just returned from there. At this moment all the manufacturing establishments in Alsace and in Normandy are very active. Their prices are so unnaturally high, that I find it very difficult to form any satisfactory comparison between our own prices and theirs.

What do you mean by unnaturally high?—I mean that their trade has been depressed for the last two or three years. At the period of the Revolution confidence was destroyed, and there was a general stagnation among all manufacturers. Last year they were exporting white calicoes to Switzerland, a country which produces them cheaper than France; this year they have had naturally a revival of the demand, in consequence of the previous diminished production. Cotton goods are now 25 per cent. higher than at this time last year. The wages of labour have risen. I was informed by Mr. Prunelle, the mayor of Lyons, one of the deputies, that the wages at Lyons had risen from 30 to 40 per cent. higher than the tariff which was established by the workmen themselves during their insurrection.

From the remarks you made upon the state and skill in the manufactures in France, do you conceive it to be equal to any in this country, or inferior?—In mechanical skill they are greatly inferior, and in manual dexterity certainly: they produce much less in the same time than we do.

By mechanical skill do you mean skill in mechanics?—I mean skill in the construction of machinery and in the use of it.

What should you say of the relative chemical skill, here and in France?—They have many beautiful improvements in calico printing by their chemical skill; in fact, it is a branch of science which is cultivated by every calico-printer in France, and there is not a ground there without its laboratory, or without its working chemist, whose business it is to carry on experiments, with a view to improve the processes.

Is that the case with the English?—It is the case on some of the more important grounds, but not universally — not to the same extent. But if I was called upon to say whether, during the last thirty years, the

more important discoveries have been made in France or in England, I should say that chemical discoveries affecting the manufacture have been made in England, much more important than those which have been made in France.

Do not the French enjoy in their cotton printing some advantage over us with regard to the brilliancy of their colours?—They enjoy that advantage which a superior climate gives them, but this is only one; they can expose their cloth with more certainty; they have a finer sun than we have; and in the fine muslins, where great beauty of execution is so important, they certainly have an advantage.

But as to their colouring matter you think they have not any advantage?—None whatever; indeed, I do not attach any very great importance to the advantage I have just alluded to.

You consider, however, that the French, from the great attention which, in their individual printing manufactories, they pay to the science of chemistry, enjoy some advantage?—I should say not a very decided advantage over us, because the application of science to calico-printing has attracted the attention of some of the leading manufacturers in this country, and very successfully.

Are there not several great manufactories in England carried on by gentlemen perfectly understanding chemistry?—There are.

Are you aware whether in any, and in what markets, the French printed calicoes are able to compete with ours?—The export of printed calicoes from France is exceedingly limited. In 1824 I took great pains to ascertain the whole production of the country, and its exports. I showed my statement to some of the principal merchants and manufacturers, both of Alsace and of Normandy, and they were satisfied of its near approximation to the truth. At that time the whole production of printed calicoes in France did not exceed 1,200,000, and of those only 200,000 were exported. They have always sent to the principal markets of Europe and America a few of their fine choice productions, where the price was not an object, and this they continue to do still; but, except to their own colonies, and a small quantity to Spain and to Italy, they do not supply the staple article, the low priced article, that which is fitted for general consumption.

Does their being able to compete with us to a small extent in some markets, arise from their turning out this work cheaper than we can do it?—I am not aware of their competing with us in low goods in any market.

(To be continued.)

NOTES AND NOTICES.

Of 1,000 sovereigns recently weighed at the Royal Mint, by a balance of extraordinary delicacy, 500 were found just the thing, 200 varied only by half a grain, 100 by three-quarters of a grain, and 100 by a whole grain: a surprising instance of mechanical accuracy, considering how many processes every single coin has to go through.

Caithness Flags are the flattest, hardest, and most tenacious of this class of stones. They are incapable of being cut by masons' irons, but they saw easily, and being truly flat by nature, they require no further dressing than being sawn square. They are found of all thicknesses, from a quarter of an inch to 3½ inches; and are so strong at 2 inches thick, that no accident which can occur, in ordinary cases, could injure a square of 30 inches, or even 3 feet. I have heated a portion red hot, and quenched it in water, without its cracking or appearing to loss its peculiar tenacity. This stone might be easily got to London as ballast in the fishing vessels from the north, where it is prepared of such thickness and sizes as may be ordered, the joints ready sawed half way through, with the rough edge left on, to protect the sharp angle. I cannot help thinking, that if its valuable properties were known to the London builders, they would employ it largely in their works, as there are so many purposes to which it is applicable. Nothing can make better pavement; as from its impenetrability by water dirt never adheres to it, and whether in rainy or dry weather it is always clean. —J. R.—*Architectural Magazine.*

Sail-worked Paddles.—We have just seen the model of a vessel, constructed on the principle of a steam-packet propelled by paddles; but from its peculiar mechanism, it completely supersedes the necessity of steam. The power is communicated by four revolving sails (gigot shaped), placed over the centre of the boat, which are acted upon by the wind from any point whatever, without in the least interrupting the progress of the vessel. The serious consequences often arising from sudden squalls are hereby completely obviated, from the accelerated action which the sails acquire, one counteracting the weight of the other in a direct ratio. The inventor, Mr. John Willis, intends taking out a patent for the discovery.—*Wexford Independent.*

Poisonous Mushrooms.—The Norwich papers contain a distressing case of three persons having been killed by eating poisonous mushrooms. If persons are determined to eat such dangerous things without subjecting them to the examination of a competent judge, it may be useful for them to know, that if they will peel an onion and boil it with them, the onion will remain white if they are genuine, *and turn black if they are spurious.* It may be farther observed that the true mushroom is seldom found in woods or in the shade; it grows chiefly in open pastures, and may be readily distinguished by its fragrant though peculiar odour.

Earthquake in Hampshire.—"*Gosport Observatory*—At about half-past ten o'clock on the night of Wednesday, the 29th Augt., a sudden shock of an earthquake was felt by many persons in the town and neighbourhood; and the tremor of the earth lasted three or four seconds of time. It was felt more along the western shore of Portsmouth harbour than in the town and at Forton; and it was also felt in Portsmouth dock-yard, Hayling-island, Porchester, and at other places along the southern side of Portsdown-hill. * * The most rational cause of the phenomena is, in my opinion, referable to an electrical discharge; for, during the preceding afternoon, the clouds were heavy, and highly charged with the electric fluid, and there was a thunder-storm to the northward of this place.

between seven and eight in the evening, which passed in an easterly direction."—*Dr. Burney.—Hampshire Telegraph.*

Mr. Hancock continues running his steam-carriages on the Paddington-road, and we are happy to say, with every prospect of complete success, so far as the matter of performance goes. Every part of the machinery of the vehicles works well; the boilers generate abundance of steam; and the road supplies plenty of passengers. No less than 650 passengers were conveyed by one of them during the last week. The two carriages which Mr. H. has now plying on this road are the Infant and Autopsy. The Infant was built as far back as 1826, and after travelling some thousands of miles in experimental trips, commenced running on the Stratford-road in Feb. 1831, being the first steam-coach that ever carried passengers for hire, or passed through the city of London. The Autopsy was built last year. A third carriage, called "The Era," has just been finished, which is built to carry eight inside and six outside passengers, and is intended to run, with the Infant and Autopsy, from the City to Paddington.

As Mr. Hancock's steam-carriage, Autopsy, was proceeding, as usual, yesterday morning to Paddington, a little beyond the Regent's-park, the carriage was in a moment brought to a dead stand. As no derangement could be discovered in any of the exposed parts of the machinery, and as most of the passengers had before been put down, he decided on making no further examination on the road, but as he wished to try the power of his last new carriage, the Era, he determined on taking the Autopsy in tow of the Era back to the station in the City-road. The latter was soon on the spot, the former attached to it, and the carriages moved off in company; but the ascent of Pentonville-hill (nearly half a mile long, and rising one in twenty at the steepest part) was the point of greatest interest; however, the hill was ascended half way with ease, when the slow motion was put on, and the two carriages cleared without any further stoppages. When it is considered that the two carriages could not weigh much short of seven tons, besides 14 or 16 persons on them, making nearly eight tons, there can no longer be any question that hills will form no formidable obstruction to these carriages, especially as the hill is in a bad state, and the road exceedingly heavy. The stoppage of the Autopsy was occasioned simply by the key in the rod of one of the slide valves within the steam-box shaking out; this was replaced, and the Autopsy started again in the afternoon at the usual hour.—*Times, Wednesday, Sept.* 3.

In consequence of the great dryness of the weather ever since January last, the temperature of the earth and of well water is now higher than it has been in any year since 1822.

Mr. Edward Austin, formerly a master in the Royal Navy, and now holding an official situation, is now forming a company for the purpose of raising the Royal George, which sunk at her moorings at Spithead, in 1782. Government have agreed (!) to give Mr. A. the vessel and all her contents, which now consist of about 60 brass guns, a chest of plate, the property of the unfortunate Admiral Kemperfelt, and a great variety of stores, including a quantity of rum in puncheons, which there is great reason to believe remains uninjured.—*Rochester Gazette.*

Mr. J. H. Payne, of Bury, has made the experiment of applying a solution of common soda as a manure with great success. The difference between vegetables so treated and those watered with common water is very conspicuous, and the vegetable marrow, in common mould, to which the alkali has been applied, surpasses in vigour plants placed on a bed of dung. The proportion used is one pound of soda to 12 or 14 gallons of water.—*Bury Post.* A correspondent of the same paper has since recommended to farmers, who may be induced to follow the above example, "to make use of the dry carbonate of soda as the crystallised soda—that is, the soda of the shops—contains from 60 to 70 per cent. of water, which can be as well supplied from the well at home, with a saving of more than half the expense of carriage." He affirms that one cwt. of the dry will go as far nearly as 2½ cwt. of the crystallised. The former, too, costs about 21*s.* per cwt., and the latter only 13*s.* 6*d.*

Steam Navigation.—A Return recently published gives the following account of the steam voyages made in the United Kingdom and its dependencies:—

	Voyages.	Tons.
1833 Coastwise	11,401	1,652,089
1832 Do.	10,329	1,501,649
1833 Foreign ports ..	1,306	132,921
1832 Do.	1,112	98,116

It appears from the above, that steam navigation has increased about one-ninth part last year, as compared with the year before.—*Hull Observer.* We have not seen the Return to which the above paragraph alludes, but presume that it does not include the river branch of steam navigation. If that were also taken into account, we have no doubt the rate of increase would prove to be far greater than is here represented.

The Post-office has now twenty-four steam-vessels regularly employed in its service; four between Liverpool and Dublin, of about 300 tons each, and 140 horses' power; six between Holyhead and Dublin, of 235 tons each, and 100 horses' power; four between Milford and Waterford, of from 189 to 237 tons, and 80 horses' power; two between Portpatrick and Donaghadee, of 110 and 130 tons, and 40 horses' power; three between Weymouth and Guernsey and Jersy, of from 154 to 165 tons, and 60 horses' power; and five from Dover to Calais and Ostend, of 110 tons each, and 40 and 50 horses' power. They perform 2,293 voyages annually—never failing once in performing each voyage within the time assigned to it—and consume about 30,000 tons annually.

Communications received from An Old Correspondent—J. C.—Quæsitor—S. B. M.—Minimus—A Bad Contriver—Mr. Edgar—Picklock—Mr. Stein.

Errata.

Page 354, col. 2, line 17, for bows read *bars*.
355, — 2, — 29, for breakwater read *breast-water*.
— — — 43, for greater read *great*.
380, — 1, — 14, after effects, for a period insert a comma.
— — — 17, for congregate read *originate*.
— — — 29, after philosophy, for a period insert a comma; and for capital H in the following word substitute a small *h*.
— col. 2, — 1, for change read *charge*.
— — — 36, for Money's read *Morey's*.
Page 381, — 1, — 42, for earthy read *earthly*.
— — — 43, after opportunities insert a comma.

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DUBLIN AND KINGSTOWN RAILWAY.

Fig. 1.

Fig. 2.

THE DUBLIN AND KINGSTOWN RAILWAY.

We select the following interesting particulars respecting this great work—one of the greatest which has been undertaken in Ireland since the Union—from a very elaborate and circumstantial account of it given by our excellent contemporary the *Dublin Penny Journal.* We borrow also from the same source the two accompanying engravings: one (fig. 1,) of which represents the railway as it passes through Lord Cloncurry's demesne, looking towards Kingstown; and the other (fig. 2,) a view of it from the Black Rock. The engineer is Mr. Vignolles, of whose skill in this class of public works we could desire no better evidence.

Description.

The entrance station is on the east side of Westland-row. The design is sufficiently characteristic of a public building, without any attempt at embellishment. The chief points worthy of attention are the beautiful granite door-cases, and cornices, from the rocks near Seapoint Cliffs, and the light elegant iron roof over the passengers' station.

To preserve the ordinary traffic of the public thoroughfares, the railway starts at an elevation of about 20 feet from the surface, and spans in succession over each street, by flat elliptical arches. For the more important streets, smaller arches for the footways have been made on each side of the principal openings.

The intervals between the streets consist of high retaining walls of limestone, obtained from the Donnybrook quarries, the space between which has been filled with sand, gravel, dry rubbish, and similar materials.

The breadth of the railway from Westland-row to Barrow-street, beyond the Grand Canal docks, is nearly 60 feet between the parapets, and is calculated to receive four lines of rails: the two central roads for the going and returning passenger trams, and the two exterior ones for the coal, granite, timber, and general merchandise waggons, which will load and unload with great facility at the sides, without the slightest interruption to the continual stream of the passenger traffic.

The railway is carried across the *quays, and a part* of the Grand Canal docks, by a granite bridge of three oblique arches of peculiar workmanship, which, though well known in England, is now introduced for the first time in Ireland, and has drawn the attention and admiration of all the operative mechanics. One arch is intended for a future street, which is marked to pass parallel to the docks; a second is for the business of the quays; the third is to pass the boats of the trade, and is provided with towing path, ranging with the general line of the dock wall. This bridge will form one of the most remarkable features of the works.

Some difficulties appear to have occurred in getting the railway past the distillery near the docks, at which it ought to be mentioned that a large station or depot is provided for the accommodation of trade. Over Barrow-street the arch is built with what is technically called *kneed, or elbow quoins;* the stones being cut so as to form an oblique or skew bed on the face of the ring, and to return to a square bed within: these quoins are of granite—the rest of the arch-stones are of the usual limestone.

At this place also the railroad contracts to the breadth of 30 feet, being adapted for two lines only for the remainder of the distance, the breadth between each of the lines of railway track being as much, however, as 8 feet. The bridge over the Circular-road is square, but across the Irishtown-road the angle of intersection is only 53°; and a granite elliptical arch, built on the oblique principle, has been introduced with good effect. The intervals between the bridges are still sustained by retaining walls, which, however diminish in height, and the crossing at Haig's distillery is the first accessible point to the railway from Dublin. This being but little frequented, the roadway has been raised by gentle approaches, and passes on the level of the railroad. A neat lodge is built, and, according to the Act of Parliament, gates will be placed across the railway, and a vigilant watch kept. We next come to a handsome bridge of three arches, across the river Dodder, with a side opening for foot passengers. The railroad here approaches the surface of the country. A little further forward, and on the north side, are erecting the buildings for the repairs and construc-

! the locomotive engines, coaches, ms, &c., and the other necessary and conveniences for the company. Serpentine-avenue the railroad on the present level of the road, gates, lodge, &c., as before. All ance of masonry now ceases: a sod bank marks the boundary on ide, with a double row of quick- ants on the top, which, in a few will form a fine hedge. Exter- he mound is formed like a slight ortification, with a berm or set-off, ich another hedge-row is planted. y wide and deep trench forms an al fence against cattle and tres- s; and thus the line runs on h Simmonscourt-fields, crossing mount-lane and Sydney-parade, will be protected, like the other with gates, lodges, and watch- At Merrion the Strand-road is l close to the old baths, with simi- otection; but, on account of the y of intrusion, the railway from n-hall on to the Strand is guarded h stone fence-walls. From Old n to the place where stood the g places at Black Rock, the rail- s elevated across the Strand, and water appears like a long mole ing into the sea. A smile will be at the recollection of the many atured predictions of the direful structive effect the winter-storms o produce upon this attempt to ature; and observing the facility pidity with which this embank- was completed, as well as that the of the storms has been to accumu- protecting bank at the footings of ter slope, not the slightest appre- n can be entertained of any future from the severest easterly gales, the stone facing next the sea is d all along, as it has been com- in parts. To afford additional y and protection, an increased is given to the banks seaward, will form a delightful promenade summer evenings. At Williams- e railway nearly touches the shore fort-parade, and another access is d: while ample culverts allow the o flow in as usual to the bathing all along the coast, which, now *construction of the sea embank- nearly finished,* will be as pure as ever, with the additional advantage of being always smooth and still.

From Black Rock to Kingstown the character of the work changes continually—high walling on the land side, and open to the sea; then passing under Lord Cloncurry's demesne, among the beautiful granite pavilions erecting for his lordship; next below the noble archway or tunnel; and beyond, through a deep rocky excavation upwards of 40 feet in depth; and below the bridge connecting the severed portions of the elegant lawn of Sir Harcourt Lees; emerging from whence, the eye catches the noble sea-view, with the distant harbour. The road will now pass close under Seapoint boarding-house, which has been accommodated with a bridge over the railroad, descending to neat baths, and to a boat pier, and other conveniences. Again occurs a portion of deep cutting, through granite rocks, with a handsome bridge of granite, to the Martello tower at Seapoint; from whence to Salthill the railroad runs at the bottom of Monkstown cliffs, with an ample promenade on the sea-side, and divided from the new foot-path by a neat iron railing. To this extent, terminating on the western pier of the old harbour of Dunleary, the works of the company are completed, and nearly ready for opening; but the last portion, on which a commencement is now making, yet remains to be described. Four acts or scenes have been passed over, viz.:—

1. The city, or mural portion, from Westland-row to Serpentine-avenue;
2. The country or rural district, from that station to Old Merrion;
3. The isolated sea embankments, as far as Black Rock; and,
4. The coast-road portion under the cliffs, and among the rocks, with the boating and bathing accommodations seaward, as far as Salthill. What follows, though less beautiful, is not less useful, and may be styled the 5th or commercial district.

It commences by striking a chord line across a segment of the old harbour of Dunleary, which segment will be filled up, and, ere long, probably covered with bonded warehouses and yards. With the accommodation of an ample wharf, sufficient cranage, and other conveniences—the cargoes of colliers, steamers,

have given him (as far as it was in my power) an explanation of this seeming paradox, but something occurred at the time that prevented me, and afterwards it escaped my memory. However, I perceive that an Edinburgh correspondent, "W.," has attempted to give an explanation of it (No. 576). I say attempted, for I think it will be easy to show that his explanation is a complete failure. I admit that his three equations, $\frac{1}{a}(b+c+d+\&c.) = \frac{1}{f}(g+h+i+\&c.)$ $\mathrm{Y}=\frac{1}{a}\left(\frac{b}{\mathrm{R}}+\frac{c}{\mathrm{R}^2}+\frac{d}{\mathrm{R}^3}+\&c.\right)$ and $\mathrm{O}=\frac{1}{f}\left(\frac{g}{\mathrm{R}}+\frac{h}{\mathrm{R}^2}+\frac{i}{\mathrm{R}^3}+\&c.\right)$ are all right. Mr. W. says, dividing the last equation by the second, then $\frac{\mathrm{O}}{\mathrm{Y}}=\frac{a}{f}\left(\frac{g}{b}+\frac{h}{c}+\frac{i}{d}+\&c.\right)$

It would be useless to inform any one acquainted with algebra that this last step is perfectly wrong. Mr. W. fancies that $\frac{g+h+i}{b+c+d}$ &c., is the same as $\frac{g}{b}+\frac{h}{c}+\frac{i}{d}+$ &c. How would it tell in arithmetic, to say that $\frac{10+8+6}{18+15+9}=\frac{10}{18}+\frac{8}{15}+\frac{6}{9}$ or that $\frac{4}{7}=1\frac{14}{45}$? He falls into another error by supposing R and all its other powers to vanish. And as these two errors enter into the after calculations, his final equation, of necessity, is untrue. The true value of $\frac{\mathrm{O}}{\mathrm{Y}}$ may be found as follows:—Let the number of terms in the series, $b+c+d+$&c. to the end of the table be n, and those of the series $g+h+i$, &c., be m, then,

$$\mathrm{Y}=\frac{1}{a\mathrm{R}^n}\left(b\mathrm{R}^{n-1}+c\mathrm{R}^{n-2}+d\mathrm{R}^{n-3}+\&c.\right)$$

$$\text{And } \mathrm{O}=\frac{1}{f\mathrm{R}^m}\left(g\mathrm{R}^{m-1}+h\mathrm{R}^{m-2}+i\mathrm{R}^{m-3}+\&c.\right)$$

$$\text{Hence } \frac{\mathrm{O}}{\mathrm{Y}}=\frac{a\mathrm{R}^{n-m}}{f}\left(\frac{g\mathrm{R}^{m-1}}{b\mathrm{R}^{n-1}}+\frac{h\mathrm{R}^{m-2}}{c\mathrm{R}^{n-3}}+\frac{i\mathrm{R}^{m-3}}{d\mathrm{R}^{n-3}}+\&c.\right)$$ See pa. 4

If the "Country Teacher" has fortitude to compute this series, taking the values of the different letters (to suit his own question) from the Northampton Tables, he will find that $\frac{\mathrm{O}}{\mathrm{Y}}=1.094$, which indicates that the value of O is greater than that of Y.

But the question may be easier solved, as follows:—

Suppose the value of an annuity of 1*l.*, on any age, is given, to find that on another age that is 1, 2, 3, &c., years older or younger. 1st. Suppose there is 1 year difference, and Y is the value of the younger life, and O that of the older: then, from what we have before shown,

$$\mathrm{Y}=\frac{1}{a\mathrm{R}^n}\left(b\mathrm{R}^{n-1}+c\mathrm{R}^{n-2}+d\mathrm{R}^{n-3}+\&c.\right)$$

$$\text{or, } a\mathrm{R}^n\mathrm{Y}=b\mathrm{R}^{n-1}+c\mathrm{R}^{n-2}+d\mathrm{R}^{n-3}+\&c.$$

$$\text{For the same reason, } b\mathrm{R}^{n-1}\mathrm{O}= \qquad c\mathrm{R}^{n-2}+d\mathrm{R}^{n-3}+\&c.$$

Hence, by subtraction, $a\mathrm{R}^n\mathrm{Y}-b\mathrm{R}^{n-1}\mathrm{O}=b\mathrm{R}^{n-1}$; or, $a\mathrm{RY}-b\mathrm{O}=b$ $\therefore$ $\mathrm{O}=\frac{a\mathrm{YR}}{b}-1$ and $\mathrm{Y}=\left(\frac{\mathrm{O}+1}{a\mathrm{R}}\right)b$. In the same way, when there is two years' difference: then $\mathrm{O}=\mathrm{R}\left(\frac{a\mathrm{YR}-b}{c}\right)-1$, and $\mathrm{Y}=\frac{b}{a\mathrm{R}}+\frac{c(\mathrm{O}+1)}{a\mathrm{R}^2}$; and so *on for any number of years of difference.*

The value of 1*l.* annuity for a life of 2 years, by the Northampton Tables, interest 4 per cent., is 15.633*l.*: wherefore, by the above formula, the value of the same at 4 years will be,

$\mathrm{O}=\mathrm{R}\left(\frac{a\mathrm{YR}-b}{c}\right)-1=1.04\left(\frac{7283\times15.633\times1.04-6781}{6446}\right)-1=$ 17.010*l.* In the same way the values for

elder 32, the numbers of each being then reduced to 70. But at this period (and for several years before) the decrements of life are greater at 32 than at 21: consequently, after this period, the gain arising from the younger annuitants will exceed that of the elder; and according to the doctrine of probabilities, a certain income will arise to the heirs of the purchasers 11 years after all the elder annuitants are extinct. But the loss sustained for the first six years on the younger annuitants, and the after gain being less than that obtained from the elder, until the younger reach 21, will fully balance the after gains at such a remote period.

Yours, &c.

KINCLAVEN.

P. S.—The following appears to me to be a more singular anomaly than that of the "Country Teacher's:"—The number of deaths in 1,000 children born, is thus estimated by different tables: by the Northampton Tables, one half only reach 8 years of age; by Mr. Simpson's London Tables, one half die before they reach 3 years; by Dr. Halley's Breslaw Tables, one half reach 34 years; by the Stockholm Tables of Mr. Wargentin, one half only reach 2 years; while the average on the whole kingdom of Sweden gives 31 years! Again, according to M. de Parcieux' Tables on the Tontines of France, one half of the 1,000 reach 30; and according to the Swiss Tables, one half attain the age of 41 years. The Vienna Tables give one half in less than 2 years; the Dutch Tables give 31 years. The average of all the Tables gives 20 years. How are these prodigious differences to be accounted for? Has Governor Fudge had any hand in constructing some of them. K.

CHILDREN CHIMNEY-SWEEPERS—SECOND LETTER.

Sir,—By the 15th section of the Chimney-sweepers' Regulation Act, it is enacted, that "it shall not be lawful for any master or mistress chimney-sweeper, or for any journeyman, servant, or apprentice of any chimney-sweeper, or for any person whomsoever, acting as a *chimney-sweeper, to call* or hawk the streets in any city, town, or village, or elsewhere, for employment in his or her trade as a chimney-sweeper," under a penalty of forty shillings.

As this clause was in the bill when it passed the House of Commons, and before I had any thing to do with it, I am not certain of the precise motives for proposing it. But I am sure it will prove a very salutary enactment. Getting rid of the nuisance of early morning disturbance to aged, and sick, and infirm, persons, will be one of its least important results.

A noble duke, who took an active part in the proceedings of the Lords' Committee, was desirous to obtain information as to the habits of the chimney-sweepers not being housekeepers, or not having fixed residences—in short, *itinerant* sweepers. By the kindness of Col. Rowan, one of the commissioners of the metropolitan police, I was enabled to propose the following questions (questions as searching as I could devise), referring to that class of persons, to the various divisions of the establishment:—

1st question. What is their number? —2d. Have they apprentices?—3d. What is the number of their apprentices?—4th. Have they persons in their employ not apprentices?—5th. What are the seeming ages of those persons?—6th. What are the characters of the masters?—7th. In what places, within the district, do they generally live?—8th. How do they treat the persons in their employ?—9th. Do they get their living, and maintain those in their employ, by sweeping chimneys alone?—10th. What are the characters of the apprentices, or other persons, in their employ?—11th. Do the masters lend their boys out to others?

By way of sample of the returns made in reply to these questions, I will transcribe that which stands first in the printed evidence, numbering the answers as the questions are numbered:—

Answer to question 1st. "Eleven."—2d. "No; they frequently hire boys in Smithfield and in other places; these are in general runaway apprentices from the country, or discarded for bad conduct; many belong to London also."—3d. "None; they sometimes impose on parishes, get the premium, and soon find means to cause the boys to run away." —4th. "Yes; occasionally." —5th. "From eight to twelve years; some

more."—6th. "Very bad; three are reputed thieves; all are drunkards when they obtain the means."—7th. (the answers are, of course, local.)—8th. "In general very badly: this they endure, because none else will employ them."—9th. "No: some steal or do any thing, to eke out the means of living and to get drink."—10th. "They have no regular apprentices, but such as they employ are bad characters, ready for any unlawful purpose."—11th. "Such masters have no boys to lend; they hire or borrow from others."

This is a fair specimen of the returns, every one of which represents the persons inquired about to be bad characters, without making a single exception. The number of master chimney-sweepers in London and the suburbs, was stated by the master chimney-sweepers, who were examined before the Committee, to be, on the average, so far as could be collected from their various conjectures, at from one hundred and fifty to two hundred. These returns number up nearly one hundred itinerant *master* chimney-sweepers. It is evident that such a proportion of the sweepers who were going about the metropolis calling for employment, being dishonest characters, housekeepers were exposed to plunder to an enormous extent on the aggregate. In fact, this body of itinerant sweepers was a complete nursery for robbery. One of the returns gives the following answers:—To question No. 4, "Yes, and not regular sweeps, but join them for the purpose of making hits or plunder, or for a reference;" to No. 6, "Very loose and disorderly, and would participate in any robbery committed by their boys;" to No. 8, "Much depends upon their industry, or by what they can get by theft, or by lucky hits, as they term it;" and to No. 11, "They are in the habit of accommodating each other at all times when there is a chance of making a hit; much depends upon what terms they are on with each other, if they are friends, and each sure the other will not divulge."

Now if hawking the streets is suppressed, the housekeeper will generally have to send an order to the house of the master chimney-sweeper, when *his attendance* is required. This will be *attended with several* advantages: the itinerants being thrown out of employment, the business of the resident masters would be increased by all that portion of the trade which the former had appropriated to themselves; the resident masters would become known to their neighbours, who would have their eyes constantly upon them—a strong inducement to them to keep their dwellings, and those in their service, as clean and decent as the nature of their avocation will permit;—the housekeeper would receive into his house, for the purpose of chimney cleaning, none but known and responsible persons, or their agents; and the nest of thieves we have been speaking of would be destroyed.

As to the idle objection which I have heard, that the housekeeper would have the trouble of sending for the sweeper, instead of calling him in from the street, it is not worth notice; nor are the nonsensical colloquies reported to have taken place at some of the police-offices.

I now proceed to another topic connected with the subject of chimney-cleansing, which will add but little to the length of my letter. I mention this topic, among others, not, be it observed, under the influence of any morbid sensibility with relation to the persons who are brought up as climbing boys, but for the sake of the public at large.

It is not generally known that soot produces that most afflicting disease, cancer. On this point Sir Astley Cooper and Dr. Domville, one of the surgeons of Greenwich Hospital, were examined. From their evidence I collect that, though comparatively few of the numerous persons coming in contact with soot become affected with cancer, yet that this cancer—"the chimney-sweepers' cancer," as it is denominated by surgeons—is a disease of by no means rare occurrence. Sir Astley Cooper had seen one hundred cases of it.

The soot, it appears, gets into the skin, where it produces irritation of a specific kind. Children are less liable to be affected than adults, the wrinkles in the skin of the latter forming nests in which the soot more readily lodges. A case has occurred of a gardener getting cancer on the back of his hand, owing to his having handled soot in throwing it over garden ground. The disease would be generally fatal, if no operation for removing

the cause were resorted to. Persons lodging in the houses of chimney-sweepers have been attacked with the sooty cancer. Soot is, under any circumstances, scarcely ever eradicated out of the skin. Dr. Domville had seen chimney-sweepers who had been many years at sea, and in hot climates, and still the soot appeared to be grimed into the skin.

Having thus briefly stated the substance of the evidence on this head, without going into the details of it, which are painful, I will dismiss it with the observations, that we must desire the human body should be, as much as practicable, preserved from coming into contact with soot; and that, although the machine now in use does not wholly effect the preservation, yet it very much diminishes the quantum of exposure to such contact.

In one of those amusing colloquies reported to have taken place at a police-office, it is said to have been stated by the waggish knight of the brush and shovel, that the fire-offices had given 100*l.* towards defraying the expenses of the opposition to the Act. I do not mean to deny the statement; but it is unaccountable to me how the fire-offices could be prevailed on to give money for such a purpose, while I read in the evidence that, no longer ago than June 7, the machine was employed instead of the climbing-boy at the following insurance-offices; viz. the Royal Exchange, the Imperial, the Atlas, the Alliance, the Protector, the Guardian, the Globe, the London the Norwich Union, the Hand in Hand, and the Union. These offices prefer the machine to the boy on their own premises; and no office in the metropolis demands an increase of premium on account of the use of the machine. Indeed, the philanthropic secretary of the Hand in Hand office is also the honorary secretary of the Society for Superseding the Use of Climbing Boys. These facts form a tolerably good set-off against the (alleged) 100*l.* subscription.

To give confidence to the public as to the safety of the machine, I will carry this matter a little further. On the same 7th of June, it appears from the evidence, the machine was in use at the following public buildings; viz. Army Pay Office; the Excise Office; the Magazine Barracks; the Athenæum; the House of Commons; the Kensington Barracks; the Middlesex Hospital; the University of London; the Bridewell Hospital; Bethlehem Hospital; the British and Foreign School Society; the King's Mews Barracks; the St. James's Park Barracks; the Knightsbridge Barracks; the Hyde Park Barracks; the Portman-street Barracks; the Regent's Park Barracks; the St. John's Wood Barracks; the Blind School; the City of London Literary Institution; the City of London Lying-in Hospital; the City of London Dispensary; the King's College; Guildhall; the Chapter House, St. Paul's; the St. George's Barracks; the Freemasons' Charity School; Guy's Hospital; Law Institution; the Guardian Penitentiary, St. George's in the East; the General Post Office (new); the Hibernian Society's Office; the Town Hall; the Ironmongers' Almshouses; the Jews' Society House; the Borough Compter; the London Hospital; the Deaf and Dumb Asylum; the London Female Penitentiary; Lloyd's Coffee-house; the London Dock House; the Lock Hospital; the College of Physicians; the Clarence Club; the Ironmongers' Hall; the Magdalen Hospital; the Mendicity Society; the Mercers' Hall; the Marshalsea Prison; the Fishmongers' Hall; the British Commercial Assurance; the Navy Office, Somerset House; the Ordnance Office, Pall Mall; the Horsemonger-lane Prison; the Tract Society; the Goldsmiths' Hall; the House of Occupation; the St. Katharine's Dock House; the College of Surgeons; St. Thomas's Hospital; St. George's Hospital; Union Club; the Royal Military Asylum, Chelsea; the Law Society Club House; the Tower of London; Union Hall Office; the Christian Union Almshouses; the Westminster Hospital; the London Life Assurance; the Crown Life Assurance; the War Office; the West-India Dock House; and others.

As to private housekeepers the machine has been gaining ground with them for some time. Glass, the maker of the most approved machines now in use, has sold 600 of them within the last seven years. I am acquainted with one individual, who has occupied large houses for about the last twenty-five years, who has never had a human being up any chimney of his during all that period, and he has never met with any

accident from fire. The members of the Society for Superseding the Use of Climbing Boys, of course, use only machines. I have not heard of any evil resulting to any of them from the practice.

The Committee of the Lords ordered that the chimneys of the House of Lords should be swept by Glass's machine—that is, such of them as were capable of being so swept—because some of them, it was admitted, could not, on account of their containing sharp angles, be swept in their present state with the machine. The order was acted upon on the 3d and 4th of July, and the result was satisfactory. Such of the chimneys as were found to be impenetrable by the machine, are, I am given to understand, to be altered, so as to render them capable of being cleansed by it.

The machines were exhibited to the Committee, and carefully examined by the noble individuals of which it was composed. I heard some of them, who had not already used the machine, express their intention to adopt it.

To rivet the whole, the Duke of Sutherland, the Chairman of the Committee, who attended in his place without one moment's intermission during the sittings, and who questioned the witnesses very closely, employs the machine exclusively at York House, and has had the few chimneys there that required such alteration, altered to suit that method of cleansing.

I have in this letter compared machines with children, merely as cleansing instruments. With relation to the detection of dangerous cracks, or flaws, or soot-holes, I am quite convinced, possessing a thorough acquaintance with the evidence, that wherever smoke makes its way into an apartment between the flooring-boards, or in any other unusual way, no examination can be relied on short of an external one, continued until the whole of the irregular communication between the apartment and the interior of the chimney is explored. If less than this is done, be assured, there is great risk of the loss of property and of life.

I am, Sir,

Your obedient servant,

ARCHIBALD ROSSER.

15, New Boswell-court,
Sept. 8, 1834.

NOTICE OF HOWARD'S QUICKSILVER ENGINE.

The quicksilver, or, more properly speaking, vapour-engine, recently invented by Thomas Howard, Esq., and now in the course of being experimentally applied to his Majesty's steam-vessel the Comet, is dependent for its principle of action on the difference between the evaporating points of water and quicksilver—the one being 212°, and the other 660°. In the steam-engine, with a boiler or generator of the ordinary form, the pressure necessary to the action of the machine varies according to the density of the steam, though the same extent of surface, or nearly so (that is, about 10 feet square per horse power), is required, whether it is worked on the high or low-pressure plan; but in the vapour-engine the steam is produced by vaporising the smallest possible quantity of water in the least possible time, and the pressure is obtained by the rarefaction of that steam, and working it expansively. The present boiler is by this means entirely done away with, as well as the whole body of water which it contains.

So much for the principle; now for the *modus operandi*. A shallow wrought-iron pan full of mercury—presenting, in the case of a 10 horse power engine, a superfices of 7 square feet, or three-fourths of a square foot per horse power—is placed above the fire immediately beneath the working cylinder, which is 20 inches in diameter. Above this mercury, and resting upon it, is a very thin plate of iron. Suppose heat to be now applied below the pan of mercury, and that its temperature is raised to between 400° and 500°* (but not higher); a shower of water, previously raised to the boiling point, is then injected upon the thin plate of iron, which covers the mercury (through a nozzle adapted to the purpose), on which it is instantly and completely converted into a steam of a very high degree of rarity. The shower is not to be continuous, but intermitting—say, one injection for each stroke of the piston. The quantity injected (which, of course, determines the power of the engine), is regulated by the movement of a small valve, adjusted either by

* The mercury would partially evaporate at this temperature, were it not prevented by the iron plate, which covers down and encloses it.

hand or by a governor. To accelerate and keep up the production of the high degree of heat requisite, there is a blowing machine connected with the furnace, which is so regulated as to supply uniformly the same quantity of air. Around the working cylinder there is a chamber, where the steam is collected before it is conveyed into the cylinder by the induction valves; and this chamber has besides an exterior casing of its own, through which any portion of the heat, which may happen not to be absorbed by the mercury, must pass before it reaches the chimney. It is found that, by means of this arrangement, the steam within the chamber (adjoining the working cylinder) may be raised to upwards of 400°, while the pressure is in general only about 10 lbs. per inch above that of the atmosphere. No condensation whatever occurs at this stage of the process. Instead of the considerable loss of effect from condensation, which takes place in the ordinary steam-engine, such an additional expansion is given to the vapour as prevents all condensation. For instance, a volume of steam, which, in contact with water, would exhibit 212° of heat, becomes expanded above the mercury to one volume and a half at 450°. To economise matters still further, the steam is worked expansively, being cut off from the cylinder at about a fourth of the stroke, giving an average pressure throughout the stroke of 12 lbs. per inch, while the pressure for the fourth part is as much as 20 lbs. per inch.

When the steam has done its duty, it is recondensed into water in the following manner:—On escaping from the working cylinder by the eduction pipe, it is received into a condensing vessel made of copper, which stands in a cistern constantly supplied with cold water. Two pumps, worked by the engine, are connected with the bottom of this condensing vessel, and a copper pipe proceeds from them, which, after many coils in the cistern, so as to expose a sufficient surface to the cold water the condenser at the lower part, being furnished at its termination therein with a loaded valve. Such quantity of liquid is introduced into the condenser, as will entirely fill the pipe and pumps, and enable *the latter to act effectively. The pumps continually withdraw the warm* liquid from the bottom of the condenser, and pass it along the pipe, by which means the heat is abstracted from it, when being injected through the valve amidst the vapour (admitted into the condenser from the cylinder), it instantly reduces it to a liquid state. In this process of condensation no air is employed, as in the ordinary steam-engine; nor is more than one supply of water required, the same water being constantly employed over and over again. A small air-pump is, it is true, attached to the apparatus; but it is merely employed to exhaust the air at starting, or to abstract such air as may enter by casual leakage. From the condenser the water is conveyed by a small pump back to the injecting nozzle of the evaporating apparatus.*

The fuel which Mr. Howard makes use of is coke. His apparatus will also work with Welsh coal—a coal that does not give out much flame; but the heating surface he employs is not sufficiently large to absorb the heat given out by flaming coal. Supposing coke to be made use of, Mr. Howard calculates that his engine may be worked at one half less expense for fuel than the ordinary steam-engine.

The Comet steamer, to which Mr. Howard is now applying his apparatus, is of 232 tons burthen, and has two 40 horse power engines. About one-sixth of her tonnage is required for the boilers, with their appendages and the water. She consumes 6¾ cwt. of coal per hour, or about 8 tons for 24 hours; and can afford to carry only 4 days' consumption of fuel below deck.†

But when Mr. Howard's engine is applied to her, the one-sixth of the tonnage which is now appropriated to the boilers, &c., will be almost entirely saved: the consumption of coke will be only 3 cwt. per hour=3½ tons for 24 hours; and she will be able to carry 70 tons of fuel below deck, being 20 days' consumption, without drawing one inch more water than she did before.

V.

August 10, 1834.

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* This mode of condensation is equally applicable to the steam-engine, with the important advantage of allowing the same water to be continually returned to the boiler.

† The Comet is of unusually small capacity in this respect: most of the Government steamers can carry sufficient coal for 8 days' consumption.

THE BRIDGEWATER TREATISES.

Dear Sir,—I am glad you have taken up the question of the Bridgewater Treatises, which, taken as a whole, are an expensive hoax on the public. The late Earl of Bridgewater was well known for his singularities, amongst which was one, that women never pardon; on which account his native home was no home for him. Of his religion I know nothing; he might have abundance of faith, but certainly it was not accompanied, in his life-time, by good works. Vanity and ostentation were prominent follies in him; and to the former is, I am persuaded, to be attributed the "magnificent bequest of 8,000*l.* for *a* treatise on the power, wisdom, and goodness of God, as manifested in the creation." Now, we have already Ray, Derham, and Paley, who have written, and admirably too, on this subject; much more so, indeed, than the Bridgewater authors. When a person proposed to write a work in praise of Hercules, it was justly observed, who ever thought of *blaming* Hercules? Now, who would imagine that the wisdom or goodness of the Deity required ten volumes to prove it? There is impiety in the thought; it is enough to make those doubt who never doubted before; and those who did doubt, doubt the more. As to the treatises generally, they are extremely discreditable to their authors; and to this there are only two exceptions— Sir Charles Bell's on "the Hand;" which contains a mass of curious information, but seldom relevant to the subject; and Dr. Roget's on "Animal and Vegetable Physiology;" a work beyond all praise, but sadly degraded by the company it is placed in.

I may perhaps return to the subject.
I remain, meanwhile,
Your most obedient servant,
SENEX.

London, Sept. 8, 1834.

CALICO PRINTING.

[Extracts from Minutes of Evidence before the Select Committee of the House of Commons, on Manufactures, Commerce, and Shipping.]

Mr. James Thomson, calico-printer, at Primrose, near Clithero, examined (14th and 18th June, 1833):

(*Concluded from last Number.*)

Has not the growth of printing in this country been a rapid one, and been attended with great improvement?—Its origin dates from the year 1690, when a small print-ground was established on the banks of the Thames, at Richmond, by a Frenchman, who in all probability was a refugee, after the revocation of the edict of Nantz. The first large establishment was at Bromley Hall, in Essex; it stood No. 1, in the Excise books, when the duty was first imposed, showing that it was at that time the most considerable manufactory of printed calicoes near London. There was a lead pump there some years ago, with the date 1710 upon it. The trade gradually increased in the neighbourhood of London; and about the year 1768, or 1769, it was carried into Lancashire, where it is now one of the great and leading branches of the cotton manufacture.

Did not a very great improvement take place in consequence of Scheele's discovery of discharging vegetable colour by oxymuriates?—The philosophical fact discovered in Sweden by Scheele, was first applied to bleaching in France by Berthollet, and subsequently brought to perfection in this country: more recently it has been applied to the discharging of dyed vegetable colours, the discovery of Mr. Koechlin, of Mulhausen, and one of the most beautiful processes in calico printing.

Was the establishment of printing manufactories in this country considered prejudicial at the time to other manufactories?—There was great hostility on the part of the Spitalfields weavers. In the year 1680 there was a general insurrection amongst them, on account of the introduction of printed calicoes from India, and the wearing Indian chintzes, and their application to bed furniture and hangings; and it was subsequently, at the instance of the weavers of Spitalfields, that the duty was imposed on printed calicoes. The same opposition was made by the silk-weavers of France to the introduction of printing into that country, on the ground of its being injurious to the silk trade.

Was not the printing first applied to linen?—It was; and subsequently to a mixed fabric of cotton and linen, manufactured at Blackburn, from Hamburgh yarn and cotton wool. Many Indian calicoes were also, in the early stages of the manufacture, printed.

Is it not of late years that the application of printing has become so general to cotton goods?—It is many years since the linen or mixed fabric has been superseded by cotton.

Are you aware of the state of printing calicoes in Ireland?—The Irish have this year been very formidable rivals in the fine London trade, and they have of late years been exporters to South America. I consider the manufacture is making considerable progress there.

Are those print-works in the north of Ireland?—There are considerable print-works

at Belfast, and also in the neighbourhood of Dublin.

Do you consider that there are any fiscal regulations which oppress in any degree the manufacture in which you are engaged, and the removal of which would be advantageous?—There are duties on dying drugs which it would be very advantageous to remove, particularly the duty on madder.

Are you consumers of oil to any considerable extent?—Yes; the repeal of that duty is very desirable also.

Are the duties of which you speak the chief impediments to the extension of the trade, so far as regards fiscal regulations?—They are, and those duties are so detrimental, that they have destroyed one branch of our industry, that is, the dyeing of the Turkey-red yarn, in which the quantity of madder used is very considerable, forming at least 60 per cent. of the cost of production.

To what do you attribute the circumstance of foreigners, at Elberfield for instance, being able to dye Turkey-red so much cheaper than we can?—The principal cause is the duty on madder, and the duty on oil. The Turkey-red yarn consumed in Russia, is English yarn dyed at Elberfield. It is sent from this country, dyed there, and then forwarded to Russia on English account. The Turkey-red yarn even for our own consumption is beginning to come from Elberfield; English yarn dyed there, and sent back to England.

Have they any particular facility, except the lower price of madder and of oil?—That is the chief cause.

Have they any other facility?—They have very much abridged and simplified the process, but that is now well known in this country; for the fact of our having lost the whole of our Russian trade, and a portion of our own, has, of course, attracted the attention of the dyers of this country, who have got Elberfield men, and are now working by the new process.

To place us in a situation successfully to compete with Elberfield, you think it would be necessary to take off the duty upon the manufactured madder, as well as madder root?—I think so.

Supposing that were done, are you of opinion that we should be able to avoid the extraordinary anomaly of sending our manufactured goods abroad to be dyed, and brought back again? I think we should, if we were relieved from the duties on oil and madder.

Is there any English grown madder?—None.

Which is the finest quality of madder?—The *different sorts are applicable* to different *purposes. The French* madder has gained very much over the Dutch, but that is very much from price.

Has inconvenience been found from the present state of the law with regard to the copyrights on prints?—Very serious inconveniences have been felt. We have protection only for three months, and, had it not been for the recent interpretation of the law by the late Chancellor, Lord Lyndhurst, it would have been of little use; this interpretation is, that no person has a right, during the three months of copyright, to make any preparation by engraving rollers or cutting blocks for the printing of that pattern which has a copyright, and still less, to print it ready for introduction into the market on the expiration of the copyright.

Will you explain what is the process upon inventing any pattern by which it is endeavoured to be secured?—The process is simply to print the name of the manufacturer, and the date when the pattern was published, upon the end of the piece. That is required by the act, and that only, and that constitutes the proof of publication.

Is any specimen of the pattern given in any where, and a record kept of it? None whatever; that was proposed in the new act which we applied for, and in which we were unfortunately defeated eight or ten years ago.

What parties were principally opposed to it?—Those persons who profit by the inventions of others, and by their pattern drawings; persons engaged in the same trade, who wait till the leading manufacturers have brought out their new prints, and then select those patterns which are most successful in the market, and those only, and bring forth imitations of them, printed perhaps on inferior cloth, and with inferior execution, and sold at a very low price.

Have you any suggestion to make with a view to remedy this evil?—The chief thing we want is an extension of the time; and though twelve months was once desired, yet I believe the manufacturers would be content with six. At this moment the shop windows of London are full of fine prints, which were introduced perhaps about the 1st of March, and on the 1st of June their copyright expired, so that the protection ceases long before the termination of the season.

Do you consider that the machinery by which you are protected is at present sufficient, but that the term for which the protection is given is not enough?—We should be willing to continue the same machinery, with an extension of three months to six.

Would you think it desirable to have the pattern registered and recorded?—I am scarcely prepared to give an answer to that question. We did conceive, at the time the

act was applied for, that a registry would be desirable, in order to facilitate the proof of the publication; but we have found that there is no difficulty, and there have been proceedings for the last two or three years under this act, with the result of which, in every respect, we are satisfied, except that three months is too limited.

Are you in the habit of employing artists for the invention and production of patterns? Yes; that is a very important and a very expensive part of our business.

What sort of men do you generally employ; are they men brought up in the manufacture, who have specially directed their attention to it, and received an education, fitting them for that purpose?—Chiefly persons who have served their apprenticeship as drawers in the manufactory.

Do you consider that we are before or behind the French, in the invention of tasteful patterns?—It is difficult to give an opinion upon that. One of the first calico-printers in France left London one or two days ago; he came here expressly in search of ideas for next spring; he has visited all the shops in London, and has gone home well satisfied. I went to Paris three weeks ago for the same purpose.

What is the number of houses engaged in the print trade, who go to the expense of preparing expensive and original designs?—I should think half a dozen.

Does the number of houses in the practice of copying exceed that number?—It does.

Do you meet with any formidable competition from the copying of your designs?—The competition has ceased in consequence of the proceedings in the Court of Chancery against them during the last two years; yet still it is exceedingly annoying, and exceedingly injurious.

Could they bring out their copies, if it were not for the protection the copyright affords, very speedily after you have brought out the original ones?—They would, in certain cases, bring them out in ten days or a fortnight, or sooner, such copies as would be very injurious.

Have you known that done?—I have; and I have known something worse done; for I have known copies brought out at the very moment the original designs were brought out; the pattern was obtained surreptitiously by bribing the workmen; and it was difficult to say which was brought out first, the original or the copy.

Are those houses which are understood to copy the designs of others put to any portion of that expense of which you have spoken as applicable to your own trade in drawing?—Not as regards the pattern they copy; and they also avoid the risk and loss arising from unsuccessful patterns; for they pick only those which are the very cream of the production.

By the interpretation which has been put upon the law, is the copyright considered to be confined to the precise pattern, or to extend to imitations of it?—Not only to the precise pattern, but to such imitations of it as are so close that one could be sold for the other, or would affect the sale of the other.

Are printed cottons now exported from this country to India?—Very extensively.

How long has that trade existed?—In the year 1798, the trade in Lancashire was very bad, and there was great difficulty in finding employment; in that year the two houses of the Peels memorialised the Court of Directors for permission to send out an adventure to India, and they shipped 5,000 pieces of printed calicoes, selected, according to the best information they could obtain from the captains of ships and mates, who had carried out small quantities before; but that adventure was very unsuccessful. In the year 1817, three years after the opening of the India trade, the exports of printed calicoes to India were 50,000 pieces and upwards; in 1822 the export was 300,000 and upwards. From a cursory examination which I have made a few days ago, I believe that the amount now is nearly half a million of pieces.

THE LATE MR. TELFORD.

The Council of the Institution of Civil Engineers, of which Mr. Telford was President from its commencement, have published the following judicious, eloquent, and well-earned tribute to his memory:—

"The Council of the Institution of Civil Engineers feel themselves called upon to address the members of that body on the occasion of the great loss they have sustained by the death of their venerable President, to express their high sense of his talents and eminence as a professional man, and their heartfelt respect for his memory. His various works are conspicuous ornaments to the country, and speak for themselves, as the most durable monument of a well-earned fame: in number, magnitude, and usefulness, they are too intimately connected with the prosperity of the British people to be overlooked or forgotten in future times; and the name of Telford must remain permanently associated with that remarkable progress of public improvement which has distinguished the age in which he lived.

"The boldness and originality of thought in which his designs were conceived, has been

qualled by the success with which they een executed, and by the public bene- hich have resulted from their use; the general admiration with which his ures are regarded is an evidence of his aste, in giving elegance of appearance most substantial fabrics.

'he profession in which, during a long ccessful career, Mr. Telford was one of rightest ornaments. has been greatly eed in public estimation by his unceas- forts for its improvement. The mem- f that profession can never forget the ity with which he patronised and en- ged young men, his ready accessibility, he uniform kindness of feeling and ity of manners evinced in his inter- with every one.

'he Institution of Civil Engineers has particularly indebted to Mr. Telford, as chosen President at an early stage formation, and has always executed his nce to promote its objects and conso- its foundation; his presents to the y and collection have been most liberal, tendance at the meetings constant, and nduct in presiding has been in every alculated to promote mutual good feel- harmony of sentiments, and co-opera- f talents."

correspondent, adverting to what we ast week of Mr. Telford's occasional ion to the Muses, says,—" I beg to you an extract from John Mayne's of the *Siller Gun*—a poem that, in pinion of Walter Scott, comes nearer productions of Burns than those of ther Scottish bard—in which you find full justice done to Telford's ble claim' to renown. After re- ng with due praise the Malcolms, asons, Pasleys, Lauries, Maxwells, , and other worthies of Dum- hire, the poet thus speaks of rd:—

' To rank amang our men o' fame,
Telford upholds a double claim;
O' fabrics of a splendid frame
The engineer—
In poesy, a poet's name
To Eskdale dear!' "

ice our last we have referred to Dr. e's Life of Burns, for the poem n we mentioned had been addressed r. Telford to the Ayrshire bard, and now extract a few verses from it, e sake not only of the light which throw on Telford's own personal y, but of the decisive evidence of al talent which they contain. Dr. *e introduces them by the following* :—" *A great number of manu-* script poems were found among the papers of Burns, addressed to him by admirers of his genius, from different parts of Britain as well as from Ireland and America. Among these was a poeti- cal epistle from Shrewsbury,* *of superior merit*. It is written in the dialect of Scotland (of which country Mr. Telford is a native), and in the versification gene- rally employed by our poet himself. Its object is to recommend to him other sub- jects of a serious nature, similar to that of the *Cotters' Saturday Night*, and the reader will find that the advice is happily enforced by example. It would have given the editor pleasure to have inserted the whole of this poem, which he hopes will one day see the light; he is happy to have obtained, in the mean time, his friend, Mr. Telford's permission to in- sert the following extracts. " — (Then follow the permitted extracts, from which we select the following):—

* * * * *

" Pursue, O Burns, thy happy style,
'Those manner-painting strains,' that while
They bear me northward mony a mile,
Recal the days
When tender joys, with pleasing smile,
Blest my young ways.

" I see my fond companions rise;
I join the happy village joys;
I see our green hills touch the skies,
And thro' the wood
I hear the rivers rushing noise—
Its roaring flood.†

" No distant Swiss with warmer glow
E'er heard his native music flow,
Nor could his wishes stronger grow
Than still have mine,
When up this rural mount‡ I go
With songs of thine.

" O happy bard! thy gen'rous flame
Was given to raise thy country's fame;
For this thy charming numbers came—
Thy matchless lays:
Then sing, and save her virtuous name
To latest days."

* * * * *

Mr. Telford was not so old as the biographical notice which we extracted last week from the *Courier* represented him to be. The plate on his coffin bears this inscription:—" Thomas Tel- ford, Esq., died 2d Sept., 1834, aged 77." His remains have been interred in Westminster Abbey, next to those of the late distinguished geographer, Major Rennel.

* Where Mr. Telford first exercised his abilities as an engineer, under the patronage of Sir William Pulteney.

† The banks of the Esk.

‡ A beautiful little mount which stands imme- diately before, or rather forms a part of Shrews- bury castle, a seat of Sir Wm. Pulteney.

NOTES AND NOTICES.

[illegible] *States.*—Holt [illegible] New York, has a steam-[illegible] the fol-[illegible] knives [illegible] water through the [illegible] travellers from one door [illegible] shaves and cuts hair, [illegible]—*Troud-*[illegible] wonderful [illegible] our knowledge [illegible] Boniface [illegible] when we were there, [illegible] them off [illegible] the plates, [illegible] handed [illegible] frizzled [illegible] shaved chins [illegible] among the [illegible] messages, kept [illegible] and answered the [illegible]

[illegible].—This under-[illegible] a mile of [illegible] they have ap-[illegible] Deptford. The [illegible] These [illegible] sub-tan-[illegible] those who [illegible] paying a [illegible] immediate upon [illegible] that the pros-[illegible] interesting. [illegible] St. Paul's, the Tower [illegible] the river to Greenwich, [illegible] of the shipping. [illegible] College, Deptford [illegible] scenery [illegible] Surrey [illegible] culti-[illegible] Surrey [illegible] views [illegible] or via-[illegible] external [illegible] running [illegible] upon the [illegible] thick-[illegible] erected, and [illegible] substantial manner. [illegible] in conse-[illegible] the Commis-[illegible] are now going on [illegible] of the stopping [illegible] very near to the [illegible] west end of [illegible] in omnibuses, [illegible] journey to Greenwich [illegible] minutes instead of [illegible] engines will [illegible] 200,000 passengers along [illegible] amount to so large [illegible]

[illegible] made from gravelly [illegible] washed out of salt-water [illegible] then powdered. [illegible] sharp river sand, [illegible] the use for [illegible] works the powder [illegible] water used in pre-[illegible] with mo-[illegible] is considered [illegible] and the most [illegible] indispensable [illegible] cement.—*Review* [illegible] *Brains.*—[illegible] *Magazine.*

[illegible] *Canal Navigation.*—Experiments [illegible] novel character, have, for some time [illegible] in progress on the Forth and Clyde canal, to ascertain the merits of an invention for propelling boats on canals at greater velocities than have hitherto been attained either by steam or horses. The principle upon which the experiments are founded may be thus described:—A light chain is laid in the canal from one extremity to the other, and firmly fixed at each end. To effect the motion a twin-boat is used, in the trough of which a grooved wheel, receiving the chain, is made to revolve by a steam-engine placed in the boat. From this description it will be evident that as the wheel revolves the boat is drawn forward, at a speed equivalent to the power, or at precisely the same velocity as the periphery of the grooved wheel. At first sight there appear to be several objections to this plan, not the least of which are the turning the bends, and meeting or passing general craft on the canal. The experiments made on Friday, the 29th ult., however, fully prove the facility with which the vessel can be steered from side to side on the canal, describing at the same time quicker curves than any to be met with on the Forth or Clyde navigation. On the whole, the experiments were satisfactory, and such as to induce further trials—a speed of 8¾ miles per hour being obtained; and there is little doubt but that, with a lighter engine, and a boat drawing less water, a higher velocity will be attained than hitherto, at a less expense than either by horses or steam.—*Scotsman.* We do not perceive any difference, in principle, between this method of navigation and the chain ferry boat of the Duke of Sutherland, of which we lately gave a drawing and description; see Mech. Mag. No. 577.

A new Observatory, far surpassing in magnitude every similar establishment, is about to be built at St. Petersburgh, by command of the emperor. The Observatory itself will consist of three towers, with moveable cupolas. Two of these towers are to be appropriated to the Konigsberg heliometer and the Dorpat refractor; but the centre tower is destined for the reception of an instrument exceeding in size all others of the kind. In the lower part of the towers the meridian and transportable instruments will be placed. Spacious habitations for five astronomers will be connected by two corridors with these towers; so that the whole will form a continuous building, 510 feet in length. Smaller subordinate buildings, for various purposes, will increase the establishment, for the site of which an eminence between six and seven miles from St. Petersburgh has been selected.—*Athenæum.*

Ornamental Chimneys.—Another tall chimney has now reared its head amongst us, and seems not only to prove an extension of our staple trade, but an improvement in taste. We allude to the steam chimney just completed for Messrs. J. Rodger and Sons, by an able townsman, Mr. S. Worth, architect. It is octagonal, and finished at top with a capital of ornamental stone work. The great height of the chimney (150 feet), and the elevated ground on which it stands, render it a very conspicuous object from the surrounding country. We hope this specimen of tasteful architecture will stimulate to further improvement the future builders of these structures.—*Sheffield Independent.*

Communications received from W. W. F.—Mr. Exley—W. H. H.—Trebor Toille—Euort—T. S.—Mentor.

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No. 580. SATURDAY, SEPTEMBER 20, 1834. Price 3*d*.

AITCHISON'S SUGAR-BOILING APPARATUS.

Fig. 1.

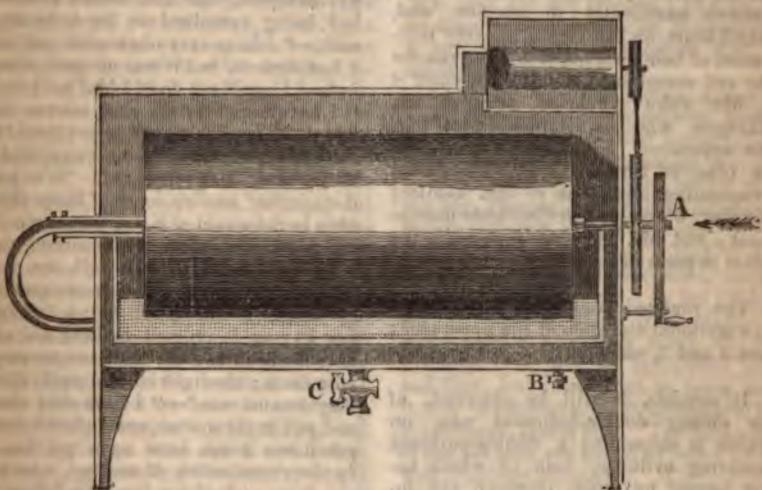


Fig. 2.

Fig. 3.

AITCHISON'S SUGAR-BOILING APPARATUS.

In the manufacture of sugar in the colonies much injury is commonly done to the syrups by subjecting the finishing process to the direct action of a strong open fire. There have been many contrivances to remedy this, but none (we believe) which can boast of more than a very limited degree of success. We have now, however, to bring under the notice of our readers, an invention for the purpose, which, we are assured, answers excellently in practice, and, which bears, on the face of it, every indication of being well calculated to remove the evil complained of. The inventor is a Mr. John Aitchison, sugar-refiner, Glasgow, who has obtained a patent for the apparatus. Some resemblance will be observed between it and the patent evaporating apparatus of Mr. Godfrey Kneller, which we described some months back; but Mr. Aitchison's patent is the older in point of date.

The prefixed engravings represent,—1. a section and elevation of the apparatus; and 2 and 3, end views.

It consists, it will be observed, of an oblong double-bottomed pan, on which is suspended a double-surfaced revolving cylinder, both of which being heated by steam (through the induction pipe A), an immense surface acts upon the syrups or liquors in the pan, and consequently a regular and rapid evaporation takes place. A strong movable wooden cover is placed on the rim or frame of the pan, having folding-doors, to open and inspect the syrups during the process, and which, when completed, are discharged by a plug (C) in the bottom of the pan, into a cooler. The vapour that rises in the pan is carried of by a small fan, placed on the top of the cover. The condensed water passes off by the pipe B. During the process the scum floats all to one side of the pan, and is easily taken off with a small ladle. The cylinder fly-wheel and fan may be turned with a handle by a common lever or lad, or by a band drum, on a shaft from a steam-engine or water-wheel, as may be most convenient to the boiling house.

CHILDREN CHIMNEY-SWEEPERS — THIRD LETTER.

Sir,—If there is no reliance to be placed on the climbing boy for the detection of a flaw, there can be none for the repairing of any such defect.

Mr. Decimus Burton, when asked whether he considered that (the boy) a satisfactory mode of repairing defects, replied,—" Not at all; there is great uncertainty whether a boy does effectually repair them." One of the master chimney-sweepers, who had been a climbing boy, being examined on the same topic, said,—" I have very often gone and said I had done it, but it was no such thing; indeed I could not do it, I had not room." " I have taken bricks and mortar both up, and I have managed to put them into the sack and taken them away, that is the way I have managed. We have done it very well up some of those chimneys in the weald of Kent, where we can put a ladder up from top to bottom, then a boy can mend it very well, but not a chimney 9 by 13. This is the position in which a boy must be up (*describing it*); he is obliged to hold his arm over his head to rest;' they cannot stop a hole there; the light is of no use to them, they cannot see."—" I have felt about and put in the mortar, and before I could get down it has been upon my head." In the examination of another, who had also been a climbing boy, the following questions and answers occur:—" Were you ever employed to fix bricks in chimneys?" " Yes, I have been employed several times."—" When you are employed to rectify defects in chimneys, how do you do that; do you take up a lighted candle?" " I have taken up a lighted candle, but we cannot use it."—" Are you able to see the flaws?" " No; we cannot keep our eyes open; the draught would drift the soot into our eyes; we are compelled to shut them."—" You do not think you have been of any use in repairing chimneys, when you have been sent up that way?" " No, none at all; I think it is all matter of form; it is nothing but deception altogether repairing chimneys." Testimony to the same effect was given by others.

Now as to the coring of chimneys. This operation is the removal of such superfluous matter as is unavoidably or

carelessly left in the chimney by the workman who builds it. The superfluities are, first, a number of small projecting bits of mortar, or other substance, in the upright or merely sloping parts of the chimney. These are removed easily, and equally well by the machine, and by the boy-body-rag instrument. But the superfluities are, secondly, lumps of mortar, and brick, and rubbish, which fall during the construction of the chimney, and harden in masses on horizontal, or very little inclined, parts of it. An extract from the evidence given by a master chimney-sweeper, who had been a climbing-boy, will elucidate this head:—

"You have been employed, perhaps, to core chimneys?" "Yes, I have."—"Can a straight chimney, an upright chimney, be cored without the aid of a boy?" "Yes; a good stiff brush, made with good stiff whalebone, will get out the fragments to come out of that chimney; but a crooked chimney a boy makes but a bad job of it. I have been coring chimneys many times. I have been in chimneys for five and six hours together, where, if there had been an aperture cut, in half an hour it might have been done with the greatest ease. I have been five or six hours in a chimney successively many and many times, and then very often come down and left it undone, and made just room for myself to get down, and very glad to get down."—"If a brick or two were left open at the time of building the chimney, could it be done effectually by a bricklayer?" "It could be done by a bricklayer much better than by a boy."—"In your opinion, there would be no difficulty and no inconvenience, when the chimney was built, in leaving a brick or two open for the purpose of affording facility for coring the chimney, afterwards to be filled up, and making the chimney good?" "Certainly, that is the way it should be done; and I have often wondered it has not been thought of. I have since put it forward myself, even lately. About our neighbourhood they say it is nonsense, the bricklayers in general; they say there is no occasion for it whatever. Boys can do it, it has been done by boys, and they may still do it; but they do not know the pain that a boy is in while he is doing it."—"*They have not been chimney*-sweepers?" "No; they know nothing about sticking in a small angle in a flue four or five hours, and to come down to get breath, and to be smothered with lime-dust, which is worse than the soot, in our mouth. They could do it well themselves all in half an hour."—Another witness being questioned, with reference to coring, "Do you often find considerable quantities of bricks and mortar?" answered, "Yes; we cored fifty-four chimneys in Jermyn-street by machine. We have got stiff brushes. If it cannot be done by them it may be dangerous to a boy, and then an aperture must be made to get it out."

Certainly, as to this second, and more troublesome, class of superfluous matter left in chimneys on their construction, it does appear that the machine may not be able to remove it, but so neither may the boy, effectually, or without protracted bodily suffering, or great danger.

It seems, however, that it may be absolutely necessary, in some cases, though they must be few,—and I do not yet feel myself bound to admit there really are any—to send a human being up the chimney. It may be *convenient* now and then, but I have yet to learn that it may be *necessary*. Let us suppose, for the moment, that it may. The promoters of the act have not aimed at doing away with climbing altogether. They endeavoured merely to prevent boys being apprenticed to chimney-sweeping at an earlier age than fourteen (the Legislature has fixed ten, instead of eight, as was the law until this session), in order that no more mere children should be brought into the occupation, none not old enough to have some judgment in choosing an employment, none not having strength and sense enough to resist unjust treatment. But what is to prevent diminutive persons, and plenty there always will be, long past the age of boyhood, small enough to climb, devoting themselves exclusively to the acquirement of particular skill and adroitness in exploring chimneys, and detecting and repairing defects in them, and coring; if these things be practicable (as, in my opinion, they are not)? Surely, assuming the practicability of such operation, there would be always within reach some man of small stature, generally known among his neighbours engaged in trades con-

nected with building, to whom recourse might be had on emergencies. Such a person would be much more trustworthy for the business for which he would be called in, than a mere child, or even a lad of seventeen (the latest age at which, generally, they can climb) who should have been only occasionally set about similar work. Such a person would be able to decide, at once, whether it would not be better to make an opening from without, rather than to labour to remove the obstruction from within: at all events, being his own master, he might refuse to be "sticking in a small angle in a flue four or five hours, and to come down to get breath, and to be smothered with lime dust, which is worse than soot in the mouth."

In the year 1818 a bill, "for the better regulation of chimney-sweepers, and their apprentices, and for preventing the employment of boys in climbing chimneys," passed the House of Commons, but was lost in the House of Lords, mainly owing to a speech of Lord Lauderdale, in which he repeated the old joke about a couple of live ducks being as good as one live goose for the purpose of sweeping a chimney, and otherwise employed against the measure, ridicule,—a weapon of the most fatal force, applied to a subject of this nature. I have before me a copy of the evidence taken before the Lords' Committee of 1818. With reference to that bill, as well as to the bill just now passed into an act, the master chimney-sweepers—the housekeepers I mean, not the itinerants—made a most determined resistance. They employed counsel at a great expense, and they spared no pains to procure evidence, several of them also appearing personally to give testimony in opposition to the bill.

In 1818 the principal machine in use was Smart's, now superseded by Glass's. Mr. Smart appears to have invented and made machines rather from benevolence, and for the credit of the thing, than for pecuniary gain. Mr. Smart gave evidence before the Lords' Committee of 1818. The following extract from that evidence will exhibit the temper of the master chimney-sweepers at that time:—

"*You did not take up the making of a machine with any view of profit?*" "*No, not at all;* for some years I threw away 100 or 150*l.* a year; but I des that it might come forward, with the of those gentlemen who took so acti part in it; and, from a circumst which occurred at the London Co house, I was quite convinced that m chimney-sweepers were no friends to —"What circumstance was th "Those gentlemen were invited ther the committee, each of them to ha machine. I was invited likewise knew nothing of them, nor they of I asked the waiter which was the wait room for the committee. I was ush into the room where the master chim sweepers were. After being there a tle while, a Mr. Green, or Smith, Mr. Porter was his partner, who then a member of the committee, that he had been informed by Mr. P what the purport of their meeting that he would take the liberty of loc the door, as we were all upon one ness. He began by telling them, th this business was suffered to go on, every gentleman who had got a le coachman or footman would be in ducing him as a chimney-sweeper, recommending him to his friends, that they who had served seven yea so dreadful a business might go rake the streets; and said a great with regard to how they ought to be to the gentlemen in the next room; it would not do for them to appe contradict them in their opinion, b side with them, and to pity the condi of the children, and a great dea that. I saw through the business p quickly. They then said they wer have each of them a machine, and they were to report on its utility day month. That, for his part, the use he should put it to would be to the fire, and that he hoped they w all do the same, and then report th would not answer. Another said, D—n the inventor, I wish he was in nerin's balloon, and I had a good and the first shot at him. I stoppe hear all the conversation I could, and they had done, I then told him that, fortunately for the business, I was dentally ushered into this room; tha name was Smart, and that I had got a tale to tell those gentlemen in the room."—"What happened then?" was the first that was called by the

mittee; and I then went away and heard no more about it till that day month."—"You stated what you had heard to the committee?" "Oh, yes."—"What occurred that day month?" "I went, expecting to have a great deal of foul language and abuse, when they knew me; but quite the reverse; the men behaved very civilly, and said they were sorry for what they had said, and hoped I would think no more of it; and if I would accept of a dinner at any tavern, they should be happy to give it me."—"Were you not perfectly satisfied, from all that passed, that sweeping chimneys by machinery would not have a fair trial from those gentlemen?" "Perfectly so; and as to the servants, I have gone out with the men early in the morning; there was a house in Tokenhouse-yard, Mr. Burke's, a very old friend of mine; we went there, the housekeeper came down quite in a passion, swearing, how dare we presume to ring and knock at the door; why could we not call out as other sweeps did; this was after we had waited an hour in the cold; she said she wished the inventor was at the devil, and the machine with him; we then proceeded and swept some of the chimneys; I asked her whether she had any objection to it now; she said a serious one; I asked what it was; she said, if there was any thing that a servant had a perquisite from, there was always some damned person to rob them of it. I asked her what she meant? she said her master allowed her so much for the kitchen chimney, and so much for the others; that the master chimney-sweeper did it for one half, and she had the other half for herself."

No attempt was made to impeach Mr. Smart's testimony.

In the Lord's Committee which sat in the present year, it was, with some difficulty, elicited from the master chimney-sweepers examined against the bill, that it is still usual for them to give the servants money. The common perquisite seems to be 5 per cent. upon the amount of the bill.

The same inveterate spirit of hostility to machinery, that existed in 1818, yet appears to possess the master chimney-sweepers. I speak from my own observation, as well as from the printed papers. *In the evidence of* the honorary secretary of the Society for Superseding the Use of Climbing Boys, are the following passages:—

"Do you know how many master chimney-sweepers make use of the machine?" "I should hope very few. They are the worst enemies the Society has. There was a very strong instance at Bristol. The people were kind enough to subscribe and furnish every chimney-sweeper in the city of Bristol with a machine, and they have since thought seriously of subscribing to buy them back again, they had so abused the public mind. I have known this conversation frequently take place:—'I have a much better machine outside the house. It is all very well—your master is a very humane man; it is all very well in theory, but it can never be adopted to general use.' The servant says, 'Well, my master is not up; you may send up the boy.' If I could prevent any master chimney-sweeper having a machine, who also keeps boys for sweeping, I should feel most happy to do it. They are the worst enemies we have."

Comment on these extracts would be superfluous. I have said as little as the subject would permit of the sufferings of children chimney-sweepers, reserving that topic for another opportunity. I am desirous the public should judge coolly on the heads I have proceeded on.

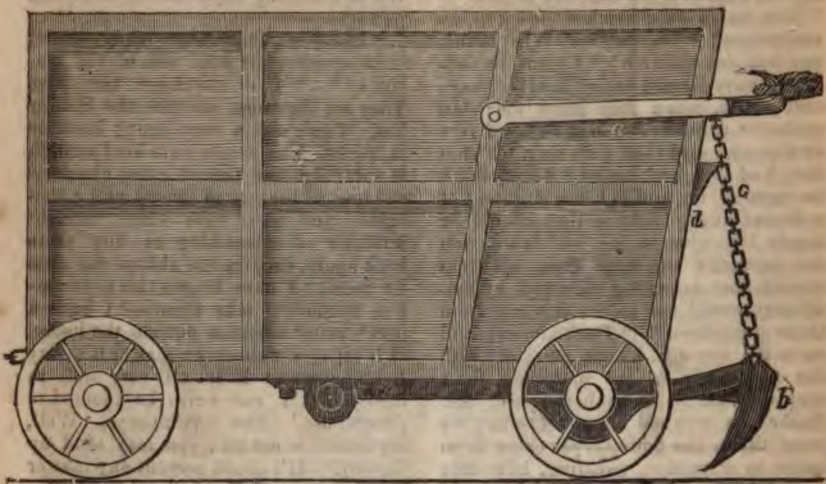
I am, Sir,
Your obedient servant,
ARCHIBALD ROSSER.

15, New Boswell-court,
Sept. 15, 1834.

WORKING INCLINED PLANES—MR. HOAR'S PLAN—IMPROVEMENT IN THE WAGGONS SUGGESTED.

Sir,—I would beg to ask your correspondents (see No. 569), if the invention of Mr. Hoar's inclined railway carriage or truck has proved a failure or not? For, from what they assert, others may be led to suppose that the persons deputed to reward the inventor did so, either without the proper exercise of their judgment, or competent discrimination; or else your informant, in No. 555, (who states that the trial terminated "with the *most perfect success*,") has misrepresented the thing altogether. For my part, I am inclined to credit a prac-

Fig. 1.



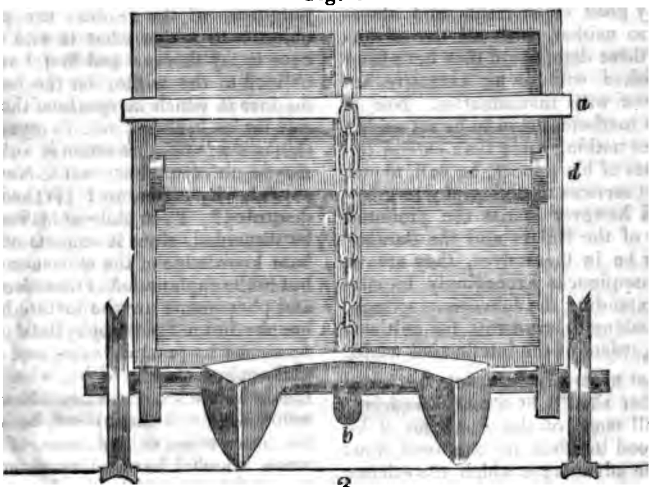
tical result, in preference to hypothetical notions, more particularly when, to give plausibility to the latter, Mr. H. is assumed to have contemplated what seems never to have entered his imagination, namely, that of having more waggons than one. If the invention answered at High Knowle, and the fort at St. Helena, with one truck, which doubtless was esteemed enough, as the ascent is within 40° only of a perpendicular; and if very much animal labour and exhaustion were superseded, up a tedious and circuitous road, exposed to the rays of the sun in a hot climate, and where the glass varies only from 70° to 90° in the shade—why, I would ask, endeavour to lessen the merit of the invention, or doubt the discrimination of those whose liberality and justice rewarded it? But the invention, garbled as it has been, is undoubtedly a good one, and suited to the purpose intended. For the spikes at the bottom of the truck are intended to penetrate a species of *rock*, which would not plough up, as supposed by Mr. Landale (p. 226), but would effectually arrest the progress of the vehicle almost at the instant it came to the ground; and I doubt not the same invention would answer elsewhere, if earth* were underneath, provided the spikes were longer and broader, as the flat bottom of the stopping-blocks would hinder the throwing up of the earth, and the earth would immediately clam, and bind closer and firmer before the clues or spikes every instant.

With reference to the modes of working inclines since published in your Journal, it must be observed, that the further the catch is from the rachet rail, the longer it will be falling, and during that time the train will have acquired an increased velocity, which, if situated upon the St. Helena railway, would be calculated to tear up the rail intended to arrest its progress; and we may guess what would follow, particularly as that represented (fig. 4, No. 569), catches the rail when the weight of the waggon has left it, which might otherwise tend to keep it in place.

The rebounding spring, occasioned by the breaking of the bearing rope, will have a tendency to throw the chain (proposed in No. 576) forward considerably, before it falls upon the toothed rail; and when it catches, would it be surprising if something gives way? Now, supposing a catch were placed, as represented in the accompanying sketches, it is probable there would be less risk of the waggons getting much way, as the catch would secure its hold in the

* *I would here observe*, also, that earth would *not remain very long upon so steep* an ascent, but *would slide off from* its own weight.

Fig. 2.



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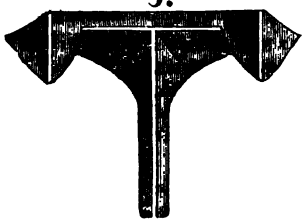

ground, or upon the rail, before that could take place. As to the necessity of a rail, I do not see that it is indispensable, as a broad-shaped claw or claws, similar to those of an anchor, would penetrate the earth very securely; and what dragging there would be, would materially prevent that jerk which the ratchet rail would occasion.

Fig. 1 is a side view of a waggon; *a* the bridle; *b* the claw and stem; *c* the rising chain, which, when the rope breaks, yields as the bridle falls; *d* are stops which check the tilting (which, by-the-bye, is very improbable with the clue so situated).

Fig. 2, the back of the waggon, showing the double claw.

Fig. 3, the claws inverted, showing the under part of a broad plate, which serves to strengthen the claws, and also prevents the earth from getting free, thereby increasing the resistance.

I remain, Sir,

Yours respectfully,

JAMES WOODHOUSE.

Kilburn, Aug. 25, 1834.

THE CLAIMS OF MATHEMATICAL SCIENCE—MR. EXLEY'S THEORY OF PHYSICS.

Sir,—In Nos. 571 and 572 of your Magazine, a paper is inserted, on the comparative value and importance of mathematical science, which contains remarks on my Theory of Natural Philosophy; on these I wish to offer a few observations.

No person, I presume, will venture to affirm that philosophy can make any tolerable advances without the aid of mathematical science; and no one will plead for the misuse or misapplication of that science. Notice the achievements of Newton: these could not, indeed, have

been effected without sufficient data furnished by good experiments and observation; so neither, with all the advantages of these data, could they have been accomplished without an extensive acquaintance with mathematics. Nor is the mere mathematician to be set aside; if he does nothing more than extend the boundaries of his science, he will render abundant services to philosophy in general; and however sterile the profound inquiries of the Eulers and the Bernouilles may be in themselves, they are in their consequences exceedingly important, as extending the domains of science, and furnishing instruments for cultivating the gardens of the intellectual world.

It is not necessary, however, that every philosopher should be a mathematician, in the full sense of the term; for if he have a good intellect, he can avail himself of the advantages which the science of quantity has already presented, just as a practical navigator may find his latitude and longitude, and work his day's work, by applying the rules which others have furnished, although, in truth, he is utterly ignorant of the principles of those rules, and of the method of their investigation.

The fact quoted from Blakey's Logic seems to prove the contrary of what is intended; for, if we have daily instances of persons making themselves proficients in mathematical science at a very early age, but never find a person becoming eminent in mental, moral, or political philosophy till more advanced in life; the conclusion is, that mathematics is the first science, since nature must not be inverted—since she, at least, places things in their true order. We need not wonder, then, that all men are born mathematicians, though many neglect or reject their birthright.

And why should mathematics be set in opposition to practice? Had Priestley, Franklin, and all practical men, the inventors of steam-engines, and others, been great mathematicians, could this have made them less practical, or less successful in their practice? Who was more practical than Newton? His optics present a model for all practical men.

The preceding observations are such as occurred while reading Mr. Cheverton's paper, and are simply submitted to the judgment of the reader; my principal object is to notice what is said in reference to my theory: and first, I am much obliged to the author for the handsome manner in which he speaks of the theory, and for his high encomiums; yet still he thinks it a premature attempt, although it may be ultimately successful. Now, if successful, why premature? Is theory to be discarded? Then philosophy itself must be discarded, since it consists not in the bare knowledge of the existence of facts, but in the explanation of those facts; facts and phenomena are the materials of philosophy, but not philosophy itself; they are furnished by practical men, and such all philosophers ought to be, whether mathematicians or otherwise. Now, if the writer does with me, indeed, believe that the numerous explanations of phenomena, which I have adduced, are really in accordance with the *theory* (I will not say *hypothesis*, because the nature of an hypothesis is to explain only the facts which gave rise to its contrivance, but a theory extends its influence to other classes of facts not thought of in its construction); if, I say, he admits this agreement, then he must allow it is not premature; we cannot too soon get into the right path, or obtain a suitable guide. On reconsidering the subject, and viewing it in its several bearings, I am more fully satisfied that the theory explains clearly the several phenomena in chemistry, electricity, galvanism, magnetism, and electro-magnetism; in its formation there was no particular reference to any of the three last mentioned—a circumstance which enhances its value very considerably.

Optics is a science which presents many very curious, interesting, and surprising phenomena: the greatest philosophers that have ever lived, have brought their mightiest efforts to bear on this subject; and the result is, that they can find only two possible ways of accounting for the facts exhibited by the subtile operations of light, in its relations to media, and bodies in general. Their conclusion seems to be, that either the Newtonian or the Huyghenian theory must be right: these are called "the rival theories." Now, after noting that the exertions of the amazing powers of the most powerful minds, have not been

able to find any other means of solving optical appearances, it would be laughed at as a silly waste of time for any man to engage in explaining the facts in any other way whatever: yet, resting on the strong foundation and truth of my theory, I have, in a work now nearly through the press, applied it also to this delightful branch of science; and, without the addition of any hypothesis, have succeeded, even beyond my own most sanguine expectations, having shown that light moves with equal velocity in all media; that the ratio between the sine of incidence and that of refraction should be constant; that Frauenhofer's dark bands ought to be expected in the solar spectrum; that the colours of thin and thick plates, as exhibited by Newton, ought to be such as he found them; that the fringes produced by defraction ought to appear; that polarisation should occur according to the laws observed; that double refraction ought to take place in media, whose parts have regular but peculiar arrangements; that circular polarisation is not less a natural result; that bodies should absorb light variously; and that we have a complete reason for the rich variety of the colours in nature.

The theory is not calculated to damp, but to excite the ardour of practical men, who will be pleased to see the connexion of their particular results with general laws: of its ultimate success I entertain no doubt. In the mean time, I shall be obliged to any gentleman to point out a single fact, in any department of natural philosophy, which is not in accordance with the theory; for, although it would yield me abundant pleasure to find my views corroborated and established by others, affording an acceptable recompense for more than twenty years' labour and excessive thought, yet I have a much stronger attachment to truth than to any system which can be shown to be erroneous: if there be a fallacy, or insufficiency, in my principles, let the same be pointed out, and the business will soon be decided; but if this cannot be done, on what ground is the theory to be rejected?

Yours respectfully,

THOMAS EXLEY.

Bristol, Sept. 6, 1834.

CAPTAIN FORMAN'S NEW METHOD OF PROPELLING VESSELS.

Sir,—Having been in the habit of amusing myself in making experiments on the different modes of propelling vessels, I read with attention, in your 576th Number, what Capt. Forman states to be his plan of propelling vessels by the means of plungers, acting upon water contained in enclosed channels, placed in the interior of the vessel.

If sufficient speed can be obtained by that, or any other mode arising out of the same principle, there is no doubt of its superiority over paddle-wheels, or any external machinery; but as the idea is not new, and has been tried over and over again, in a variety of ways, it is to be feared that the velocities obtained have been greatly inferior to that of paddle-wheels, otherwise a plan, in every other respect so manifestly superior, would not be kept in oblivion, but would, on the contrary, be seen upon the Thames, competing with the paddle-wheel steam-boats.

That the idea of propelling vessels by a jet of water is not new admits of proof. The late master millwright of his Majesty's dockyard, at Portsmouth, took out a patent for a method of this sort, which is now expired; he experimented on it in a man-of-war's launch, and I was told she was propelled with a steam-engine at the rate of four miles per hour. Another plan on the same principle, with this difference only, that the movement is circular, has been lately brought forward at Colchester (by Mr. Hale), and has been much admired both at home and abroad; however, notwithstanding it has been tried upon a large scale, it yet remains behind the scenes, and we hear of no successful competition, as to speed, with the old plan, which in every other respect is so objectionable. The ingenious Mr. Boswell also turned his attention to this and other modes of propelling vessels; and there is a very clever communication of his contained in the 26th volume, Second Series of the "Repertory of Arts and Manufactures," on propelling ships by compressed air. Although his communication is as far back as the year 1814, he mentions propelling vessels by a jet of water, as follows:—" Having

heard of various methods of propelling vessels by the action of water, forced in a jet against the medium in which the vessel floated, none of which appeared to me to be of much use, and some tried on a large scale had no success, it occurred to me that the action of air upon the water would be more likely to succeed," &c. The above quotation of itself plainly shows that the idea is old.

If, through the medium of your valuable journal, Captain Forman will hereafter make the public acquainted with the manner his plungers have behaved, by their avoidance of friction (a little waste water being of less consequence perhaps); and if we were also made better acquainted with the rate of speed obtained by the Colchester steam-vessel, comparatively with others of similar tonnage and power of engines, the scientific world would then be the better enabled to form some judgment of the merits of the plan in question; and if, by such a principle of propulsion, there existed *a hope* of obtaining a velocity even nearly equal to the paddle plan, there is no doubt but that the energies of mechanical men would be directed to the attainment of so desirable an object.

I am, Mr. Editor,

Your obedient servant,

O.

September 13, 1834.

PAPER FROM RUSSIA MATTING AND INDIAN CORN LEAVES.

Sir,—Few persons are aware that the vegetable rush, which is afterwards formed into the article called "Russia matting," is a suitable material for making paper; but I can assure them, that two very good sorts of paper may be made out of it. *Old* matting, such as has been previously applied for packing purposes, &c., if used in the proportion of about one-half, with another article called "bagging," will make that species of whity-brown paper known by the name of "small-hand." The cuttings of *new* matting (having more strength, *when brought to the proper colour by bleaching acids*), will make either a *good second-quality of* printing, or writing paper. The Rev. Mr. Carpenter, previous to enlisting under the banners of Joanna Southcott, was superintendent of the Neckinger paper-mills, Bermondsey (now converted into a parchment-manufactory, belonging to Messrs. Bevington), and a most talented and feeling-hearted individual he showed himself to be while there. He once showed me a sample of printing and writing pott and foolscap, entirely manufactured out of Russia matting, and I remember that it bore the ink well. This was at an early period of the last war, when the supply of foreign rags was so inadequate to the demand, that shopkeepers were recommended by handbills to save the paper sweepings of their shops, with an offer of a good price from the collectors.

Another article, whose suitableness for paper-making has been brought to light by Mr. Cobbett, seems to be totally unattended to—I mean the leaves which envelop the Indian corn. To place its fitness for this purpose beyond a doubt, Mr. Cobbett, with his usual clear-sightedness, had his book, "On the Culture of the Indian Corn," printed upon paper made from its leaves; the manufacturer was Mr. Rowland, who has by no means, however, given it "the look" he might. On my going through that filthy district called "Duke's-place," inhabited principally by the Jew orange-dealers, I was surprised to see nearly the whole surface covered with this species of leaf, which it is customary to roll round the oranges previously to packing them abroad, and which these cunning tribes of Israel (knowing as they are in most pecuniary matters), consider to be of not the least value, and suffer to rot every season on the ground. Were they taken care of, the paper-maker would be glad to purchase them at a very recompensing price. The same prodigal waste of this article is displayed in Covent-garden market, where many tons, in my opinion, are wasted every year.

Wishing these hints may prove useful,

I remain, Sir,

Your obedient servant,

ENORT.

Marlborough-terrace, Albany-road.

ᴉᴇ ASSOCIATION FOR THE PROMOTION OF SCIENCE.*

fourth annual meeting of this flou-
· association was held at Edinburgh
the past week. The president, on
ccasion, was Gen. Sir Thomas Bris-
the vice-presidents Sir David Brewster,
ıe Rev. Dr. Robinson, Astronomer-
of Armagh; the secretaries, J. Robison,
Sec. R.I.E., and Professor Forbes, of
ırgh.

ᴛ DAY'S PROCEEDINGS—MONDAY, SEPT. 8.

members of the Association, to the
r of 350, dined together, Professor
ick, the president of last year's meet-
the chair.
ore the party separated, the Professor
nd proposed the health of the King.
en said, that although it had been
not to propose formal toasts, circum-
s would probably justify in one in-
a departure from strict rule; he
d to the presence of M. Arago, the
ıomer-royal of France, whose appear-
ımongst us he hailed as a gratifying
that the times were gone past when
ıhmen and Frenchmen regarded each
as natural enemies. The health of M.
was then proposed, and the toast was
ed with the utmost enthusiasm.

Arago rose to return thanks; he passed
y over the routine phrases, and dwelt
e length on the advantages that must
from the union of the minds of Eu-
he regarded it as the pledge of the
of the world, because intellectual su-
cy daily acquires more direct power
he affairs of nations, and when the in-
ual rulers are banded in friendship,
.tions subject to their influence cannot
ced into hostility. These noble senti-
were delivered in a manner that
carcely be described. M. Arago pos-
great physical advantages: in figure he
bles the Farnese Hercules; his voice is,
same time, powerful and melodious—
ction rounded and graceful; his style
nuch like that of the late Mr. Can-
.

er dinner, the meeting was formally
enced in the Assembly-rooms, which
oprietors had fitted up with great taste,
laced at the disposal of the Association.
were present in the rooms about twelve
ed members, and four hundred ladies.
ssor Sedgwick, the chairman at the
ridge meeting, came forward to resign
esidency to Sir T. Brisbane, and ad-
d the meeting *to the following* effect:—

The duty which he had that evening to perform was an humble one. The Association had exalted him to a high honour, from which he was then on the point of retiring, and he did so with feelings of exultation rather than regret, inasmuch as the trust he held would devolve on one whom they all knew was more capable of performing the duties of it. He, however, would enter on the trust which was not in a bankrupt state, but was going on increasing in prosperity, and would produce an effect on the philosophic world, which would extend to ages yet unborn, and tend to promote the best interests of humanity. The learned Professor proceeded to expatiate on the advantages of an association of this nature. Distinguished men from various parts of the continent and of this kingdom were congregated here, who would mutually enjoy each other's conversation. This was one advantage of philosophic unions; but there were many other circumstances which pointed out the use of the Association. What was man alone?—why in a savage state. He could not be said to have power even over brute matter; but, when associated with his fellow-creatures, he gained power as he gained knowledge. This was the great good which arose from association, for there was a power derived from concentration quite different from that which a man possessed when acting by himself. It was said the greatest philosophic discoveries had been achieved in private; but it would be found that the sparks which kindled them originated from mingling with the world, and having intercourse with men of kindred spirits. He strongly deprecated any infringement of the rules of the Association, for if it should ever break up, he might predict that it would be by overstepping its laws, and entering upon political topics, which were totally foreign to the institution.

Sir Thomas Brisbane then took the chair, and shortly addressed the meeting. He congratulated the Association on its present state of prosperity, and hoped its advantages would extend to the remotest parts of the globe.

Mr. Robison, one of the Secretaries, gave an account of the arrangements which had been made for the accommodation of the members, and the general order of the business of the week.

Professor Forbes afterwards gave an outline of the different subjects under discussion, mentioning the names of the individuals by whom reports in their respective departments would be drawn up.

SECOND DAY—TUESDAY.

The different sections elected their respective presidents and committees, after which each proceeded to business.

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*r the following details we are partly in-
o the Athenæum, and partly to the Times.*

In the section of *Mathematics* and *General Physics*, Dr. Brewster read a paper on capillary attraction, after which an interesting discussion ensued, in which Professor Whewell, M. Arago, Professor Forbes, and Professor Powell, took part.

In the section of *Geology* and *Geography* an animated discussion took place, in which Professor Sedgwick, Dr. Buckland, Mr. Greenough, Mr. Murchison, Professor Lyell, and Mr. Phillips, took a leading part, on a question proposed by Dr. Boase—"Are the primary rocks stratified?" On this point Professor Sedgwick delivered a most instructive and impressive discourse, in which he contended for the impossibility of drawing any fixed line of distinction between the so-called primary rocks and those deposits which contain organic strata. The Professor drew all his illustrations from the English and Scotch rocks, which he maintained afforded ample proofs that the proposition of Dr. Boase was perfectly untenable.

The section of *Chemistry* and *Mineralogy* was principally occupied with a discussion on certain experiments made by Dr. Daubeny, on the nature of gas from thermal springs. The atomic theory also formed one of the prominent topics of discussion, in which Dr. Dalton, Dr. Turner, and Messrs. Johnston and Harper, took part.

In the section of *Natural History*, a report by Mr. Jenyns, on the recent progress and present state of zoology, was read. The first part of a paper was also read by Professor Hooker, giving an account of an excursion in Quito, and to Chimborazo, by Colonel Hull. The Professor pointed out as particularly deserving of attention the general similarity of the climate of these districts to the climate of the south of Europe, and at the same time the injurious effects produced by the continuous spring, contrasted with the beneficial influence on animal and vegetable life of the alternate seasons of other climates.

In the section of *Statistics*, Colonel Sykes stated that he had some statistical returns relating to the Deccan, which, however, were not yet in a fit state for publication. It was mentioned that in addition to the Statistical Society recently established in London, another had been formed in Manchester, under the superintendence of Mr. Benjamin Heywood of that city. This association had already acquired much important information relative to the state of the working classes of Manchester, having visited no less than 4,102 families, comprehending nearly 20,000 inhabitants; of this number 8,851 were children, and of these 252 attended day-schools, and 4,480 attended Sunday-schools, so that nearly one-half were entirely destitute of education; 689 families were found in comfortable circumstances, 651 less so, and upwards of 2,500 in uncomfortable circumstances.

In the section of *Anatomy* and *Medicine*, a paper was read by Dr. Allison on the dependence between the muscular irritability and the nervous influence.

In the evening there was another general meeting at the assembly-room. Sir Thomas Brisbane, the President, called the attention of the meeting to the reports of the transactions of the various sections during the day, which were then read by their respective presidents, but which it is unnecessary to repeat here, being only a short summary of what we have before stated. This business having been concluded, the Chairman called upon Professor Robinson, of Armagh, who then addressed the company at considerable length upon the subject of comets. The term "comet" had, he said, been from the earliest times almost synonymous with spirits, terror, and all the pageantry of unholy and superstitious apprehension. They knew that still such terrors were found—they knew that lately in Paris, the capital of one of the most civilized and enlightened nations, such a panic prevailed at the expected return of one of these strangers, that to calm the apprehensions of the people, it was necessary to have recourse to one of the most eminent philosophers, M. Arago, to satisfy them that they were neither in danger of being suffocated by its noxious influence, nor crushed to pieces by its concussion. But to philosophers it presented itself in a far different aspect. Instead of announcing a tempest or a revolution, or the forewarning of some dreadful scourge in the world, "with the fear of change perplexing monarchs," which its presence formerly conveyed to the mind, they now beheld in its track one of the greatest triumphs of human genius, and derived the strongest conviction that the person who should pretend to say to human knowledge—"Thus far shalt thou go and no further," was as yet in blindness—in infancy—unpractised in his strength—ignorant of the state of power to which the human mind could be raised. The learned Professor then entered into a most interesting disquisition on the history of the great Halley comet, which it was calculated would once more appear in the latter end of the present year, although it would not make its nearest approach to the earth until the 6th of January, 1835. This expected comet would bring another triumph to those who would hail with exultation its prompt obedience to the mandate of the mathematician. He concluded by giving a scientific analysis of the interesting subject of cometology. During his speech, Professor Robinson made some

observations upon the nature of light, in which he advocated the undulating theory.

Professor Whewell followed up the observations of Professor Robinson by explaining that part of the subject which is usually involved in ambiguity,—namely, the tail of the comet. By diagrams he illustrated the causes of the alteration in the size and brilliancy of these appendages of comets, and showed that they resulted from the proximity of the body to the sun. The interesting subject of the existence of a thin ether filling all space was brought under notice, and the retardation in the periodic return of comets was mentioned as a proof of the fact. Professor Whewell also alluded to the physical constitution of comets, showing that from the tenuity of their structure, &c., all apprehensions as to the injury which they could inflict on our globe were groundless. They were, in fact, clouds of radiant dust, which might pass over us like a simoom across an African desart. He also took occasion to make some remarks upon the density of some of the smaller planets, Mercury, for instance. The matter composing some of these must, he observed, be lighter than water; but as a fluid body could not by any cohesive principle exist together under such a temperature as that to which these planets are subjected, we must therefore consider them to have a physical structure something like ashes or pumice-stone.

A report was read by Mr. John Taylor, the treasurer, from which it appeared that the number of tickets issued to new members on the present occasion amounted to upward of 800, and that 150 more had applied, and would probably be admitted on the next day. The Association, at its commencement at York, numbered 350 members; at Oxford they increased to 700; and at Cambridge last year to about 1,400; so that at Edinburgh it already included 2,200, which would in all probability be increased to 2,500 before the present meeting was concluded.

THIRD DAY—WEDNESDAY.

The committees of the various sections met in the college at half-past ten o'clock, and shortly after eleven o'clock all the sections were busily engaged in discussing their respective branches of science.

In the section of *Mathematics*, Professor Powell brought forward his views of dispersion in reference to the undulating theory. Meteorology also formed a prominent feature in the discussions of the day. On this Mr. Phillips read a report, which was afterward discussed at great length by M. Arago, Sir Thomas Brisbane, and others. Amongst other meteorological subjects, the origin and suspension of clouds, the origin of hail, &c. were also dicussed.

In the section of *Chemistry*, crystallography formed a prominent object of discussion. A paper by Dr. Williams, on combustion, was read. Dr. Daubeny read another on the relative heating powers of coal-tar and splint-coal, in which he showed that the tar might be used in fuel to increase combustion; but that it did not give much more heat than good coal. A third paper was read with regard to the destructive distillation of organic substances.

In the section of *Geography* and *Geology*, Mr. Stevenson's report as to the relative levels of land and water was read. This called forth some very interesting remarks from Mr. William Smith (the father of English geologists), as to the gradual encroachments of the sea on some parts of the coast, in the course of which he brought forward some facts tending to disprove the popular notion that England and France were once united. Professor Lyell (who has recently returned from Sweden) gave a very lucid account of the result of his observations on the coasts of Norway and Sweden, the result of which he stated to be a firm conviction in his mind that a gradual but regular rise is taking place on that part of the coast which lies in the neighbourhood of the Baltic. From marks which have been set up by the Swedish Government, and measurements made under the superintendence of the most eminent geologists of that country, he estimates that a rise of somewhat more than three feet has taken place in the last 100 years. A paper was also read by Lord Greenock on the coal fields of Scotland.

The principal subject of discussion in the section of *Natural History* related to the question of the altitudes at which certain kinds of vegetation exist. The limit of perpetual snow was another subject of discussion, the result of which was, that theory and observation were often at variance with regard to it, the character of the country always forming an important element in determining at what height snow may be found permanent.

Section of *Medicine*.—In this section only a few papers were read, which did not call forth any discussion of importance.

Section of *Statistics*.—In this section a paper was read on the advantages of infant school education. A paper by Dr. Clelland of Glasgow was also read, containing much valuable information respecting the statistics of that city, in the course of which he took occasion to remark on the numerous inaccuracies of the parochial registers; he also stated that he had found that the opinion

very generally entertained in Scotland, that the average annual fatality of Glasgow exceeded that of other places of a similar size, proved by comparison with Manchester and other places to be incorrect.

The assembly in the evening was very numerously attended. Sir Thomas Brisbane having taken the chair, the presidents of the various sections read the usual reports, after which Dr. Lardner delivered a short lecture on the merits of Mr. Babbage's calculating machine, which gave great satisfaction, and evidently identified the lecturer as the author of the very able article on the same subject in the last number of the *Edinburgh Review.*

THURSDAY—FOURTH DAY.

In the *Mathematical* section a paper was read by Professor Rennie on the subject of hydraulics, embracing some notices of the river Thames previous to the erection of the new London-bridge. Mr. Phillips read a paper on a new form of the dipping needle, whereby errors regarding the centre of gravity could be corrected. Professor Robinson made some observations on the Edinburgh observatory, showing the great necessity of some scientific improvements.

In the *Chymical* section, the most important part of the business was a discussion on chymical notation, which was introduced by Mr. Johnston; the subject was referred to a committee, with a view of introducing a more uniform system.

In the *Geological* section Mr. Nichol read a paper on the structure of fossil wood.

Professor Traill opened a discussion on some fossil remains found in Orkney, which was taken up with great energy by M. Agasis.

In the section of *Natural History*, Mr. Selby read a lengthened notice of the birds observed and obtained during an excursion in Sutherlandshire, and on the structure and use of the orbital glands. Sir William Jardine read a paper on the various species of the genus *salmo*, collected during the same tour, exhibiting specimens and drawing. On this subject some observations were made by Monsieur Agassis and Dr. Richardson. Mr. Trevelyan read a notice on the distribution of the phenogamous plants of the Faro Islands. A paper was read by Mr. J. G. Dalzel on the propagation of Scottish zoophytes, illustrated by many beautiful drawings. He stated that he had kept some individuals of this species alive in his house for several years. Dr. Arnott read a paper on the coculus indicus of commerce, and Mr. Murray made some observations on his success in cultivating phormium tenax.

In the section of Anatomy and Medicine, Sir Charles Bell delivered a lecture on the nervous system.

In the *Statistical* section a discussion ensued on the present state of the new statistical account of Scotland now in progress.

Lord Fitzwilliam suggested that some means should be taken to obtain more minute details regarding the subject of agriculture. On the suggestion of Lord Jeffrey, the committee undertook to communicate with the Highland Society on this subject.

At the meeting in the evening, Dr. Buckland delivered an interesting and amusing lecture on rare and extinct species of fossil reptiles.

FRIDAY—FIFTH DAY.

At the evening meeting, Sir Thomas Brisbane called for the reports of what had been transacted in the different sections during the day.

Professor Robinson read the report from the section of *Mathematics* and *Physics*, at which, among other topics, Dr. Knight had explained the method of rendering the vibrations of heated metals visible to the eye.

Mr. Russell read an account of certain experiments relative to the traction of boats at considerable speed on canals.

Sir D. Brewster read an account of a series of experiments relative to the surfaces of crystal when in solution.

Sir T. Brisbane made some remarks on a kind of silicious sand found in New South Wales, from which glass of a superior quality is manufactured.

Dr. Christison read the report from the section on *Chemistry*, in which papers on various subjects connected with the science had been read by Mr. Harcourt, Dr. Clark, Sir David Brewster, Mr. Graham, and Mr. Kemp.

Professor Phillips reported from the section of *Geography* and *Geology*, that Mr. J. Bryce had read a paper on certain bones found in a cavern near the Giant's Causeway. Mr. Murchisson had also read a paper on the fossil fishes found in the old red sandstone of England, and also in Forfar, and other counties in Scotland. Dr. Traill announced that the fossil fishes he had brought from Orkney had been inspected by M. Agassis, who had discovered among them five new species. M. Agassis also read a paper on certain fossils found in the quarries near Burdiehouse, which he conceived at first to be reptiles, but which were in reality fishes, partaking of the character of reptiles. This remarkable fact was now brought for the first time under the notice of science.

Professor Graham read the report from the section of *Natural History*. In this section Dr. Traill had made some observations on a new species of thrush found in Brabant. Mr. Pentland made some observations on

the remains of what appeared to be a extinct variety of the human race, which had inhabited a district in South America, extending from the 16th to the 19th degree of south latitude. From relics found in various places, it appeared that ⅔ths of the brain was placed behind the spinal column, the consequence of which conformation would be that they would have great difficulty in keeping their heads erect, and be more inclined, as the Professor humorously observed, to be star-gazers than geologists. It ought to be observed, however, that Mr. Pentland failed to convince the section that this conformation arose from any other source than the habits of savage life. Sir D. Brewster gave a masterly account of a remarkable structure in the webs of the feathers of birds, for keeping the laminæ from separating during flight. This fact had hitherto escaped observation.

Dr. Abercromby reported from the section of *Medicine*, that several papers on that subject had been read and discussed. The learned doctor then took occasion to express the gratification he and his brethren had experienced from the meeting of the British Association in Edinburgh, and their anticipation of the happy results to which the friendships thereby commenced might lead. He was not one of those who were of opinion that the pursuit of physical science was hurtful to the higher interests of man considered as a moral being. He believed that infidelity and irreligion were the offsprings of ignorance, united to presumption; and that the boldest researches in physical science were calculated the more to display the power, the wisdom, the harmony, and the beauty which marked the works of Him who guided the planets in their course, who ruled a thousand suns and their systems, and whose name was the Eternal.

Colonel Sykes reported from the section of *Statistics*. Here Mr. Drinkwater had related the progress made by the Statistical Society of London, which now consisted of 400 members, connected with every part of the kingdom. Captain Maconochie read a long and interesting paper on the population and state of crime in France.

Mr. Whewell then delivered a lecture on several interesting phenomena connected with the tides. At the last meeting of the association, the investigation of this subject was pointed out as of vast moment, and one from which facts of considerable importance were likely to result. He observed, that the state of information with respect to tides, amongst philosophers, was precisely in the same situation as that with respect to the general *principles of astronomy* among those *who were least learned*. The general fact of tides being governed by the law of gravitation and the attraction of the moon and the sun was known to the learned, but of the particulars they were in a great measure ignorant. At the last meeting he therefore called upon intelligent individuals to institute investigations upon this subject, and the consequence had been that at Bristol a society was formed for the purpose of carrying on these investigations,—Bristol, which was above all other places calculated for observations, as the rise and fall of the tide there averaged from 50 to 60 feet; a person might walk at low water along the valley of the river, and see the ships lying dry, never dreaming that in a few hours these would be floated by the tide. To facilitate these inquiries, a self registering instrument was constructed to ascertain the rate of the rise and fall of the tides, by which the relative altitudes at different times of high water were delineated on a sheet of paper, one of which was exhibited to the meeting. By this means, the fact, first developed by Newton, from observations made by a gentleman residing at the spot where this instrument was now adopted, was verified, that at one period of the year the evening tides were greater than the morning, and at other times the morning tides were greater than the evening. This circumstance could not be observed in London; and this arose from the peculiar position of that city, which he believed to be unique in the tides of the coast. Mr. Whewell then described the manner in which tides were brought to our coast, and showed that the great tidal wave of the Atlantic in approaching the shores of England divided into three columns, and that two of them met exactly at the mouth of the Thames, one of them twelve hours after the other, so that each tide was compounded of an evening and a morning tide, and in consequence there was no alteration in the daily tides of that port. In order to prosecute the investigation of these phenomena, application was made to the Admiralty to direct the Coast Guard service to make observations on the subject; and the officers of that service had shown an alacrity and zeal in the matter which was worthy of their character. He had received their observations from the 7th to the 23d of June last, but he had not yet had time to examine them fully; but from the cursory view he had been able to take of them, they appeared to be of great value, and they were at present undergoing investigation by direction of the Admiralty. Mr. Whewell concluded his interesting lecture by expressing, in very warm terms, the feelings of gratitude entertained by himself and other strangers of the Association, for the kind and hospitable reception they had met in Edinburgh.

Professor Sedgwick, at some length, took a general review of the results of the labours of the *Geological* and *Geographical* sections during the week, in the course of which he learned Professor detailed the relation which subsisted between the geological formations of the sister kingdoms. Geology, he observed, had made a very important advance during this meeting, in the course of which he himself had gained new views of the science. M. Agassis, in particular, had brought to light several interesting facts relative to fossil remains.

SIXTH AND LAST DAY—SATURDAY.

The last meeting was held in the Hall of the College Library, Edinburgh.

The President announced that the next meeting would be held in Dublin on the 10th day of August, 1835; Provost Lloyd, of Trinity College, Dublin, to be president.

The Rev. Vernon Harcourt, general secretary of the Association, then read a long report, embracing, in a general view, the principal topics which had been discussed during the week, and the objects to which they wished the attention of the members to be directed during the ensuing year. He also read a list of contributions from the Association for promoting several scientific pursuits.

Dr. Buckland proposed the thanks of the Association to the patrons and officers of the University of Edinburgh, for the handsome and liberal way in which they had given them the use of the rooms in the University. He said that throughout the week they had been received in the metropolis of Scotland in a way which was worthy of the far-famed hospitality of the nation. They had been welcomed to the houses and to the tables of the inhabitants—nay, the very rocks of the country had welcomed them by opening before them their valuable treasures; they had seen that the Grampians had formerly had spices waving on their tops, while at their bases the crocodile swam, and a thousand fishes had started from their rocky sepulchre, to bid welcome to the members of the British Association for the advancement of science. After some further remarks, the learned Doctor concluded by proposing his motion, which was seconded by the Provost of Trinity College, Dublin.

Various other motions of thanks were put and carried.

Professor Sedgwick, in proposing the thanks of the Association to M. Arago and the other distinguished strangers who had visited them, again made some pertinent and eloquent remarks upon the advantages of *science in smoothing* the prejudices of different *nations, and linking* together learned *men of all countries.*

The Lord Chancellor rose, amidst loud cheering, to second the motion. After apologising for not sooner appearing at the meetings of the Association, which he said was attributable to accident, he remarked that he understood he owed the honour of seconding the motion of his rev. and learned friend to the circumstance—one of the proudest in his life—that he was a member of the National Institute of France. It had been often remarked that war was a game at which, if the people were wise, governments would not often play; and he might add, that in encouraging and fostering the exertions of men of science, who were of no party, and over whom the angry tempests of war passed innocuous, a government was taking the best means to facilitate that which ought ever to be their chief aim—peace on earth, and good-will among men.—(Applause.) He might remark also, that as among individuals, the older they grew, they became the more sensible that life was too short to be spent in personal quarrels, so he was happy to say, that the world was now too old, and too experienced, for neighbouring states to engage in war with little or no ground of quarrel. A great part of this softening influence was to be attributed to science, which formed a bond of brotherhood between learned men of all countries. It was, therefore, on scientific principles, and on the principles of an enlightened philanthropy, that he cordially seconded the motion of his rev. friend.

M. Arago returned thanks in a French speech.

The President then addressed the meeting at some length, congratulating the Association on the result of their labours, and on the hospitality with which they had been treated in Edinburgh—a circumstance of which, as a Scotchman, he could not fail to be proud, and of which he himself had largely shared, having had the honour that day of being presented, along with four other distinguished individuals, with the freedom of the city of Edinburgh. The gallant general then adjourned the Association to Dublin on the 10th day of August, 1835.

Communications received from Mr. Baddeley—Mr. J. R. White—R.—A Constant Reader—A Member of the Lond. Mech. Inst.—And Old Subscriber—Mr. H. Cunningham—Mr. Harris.

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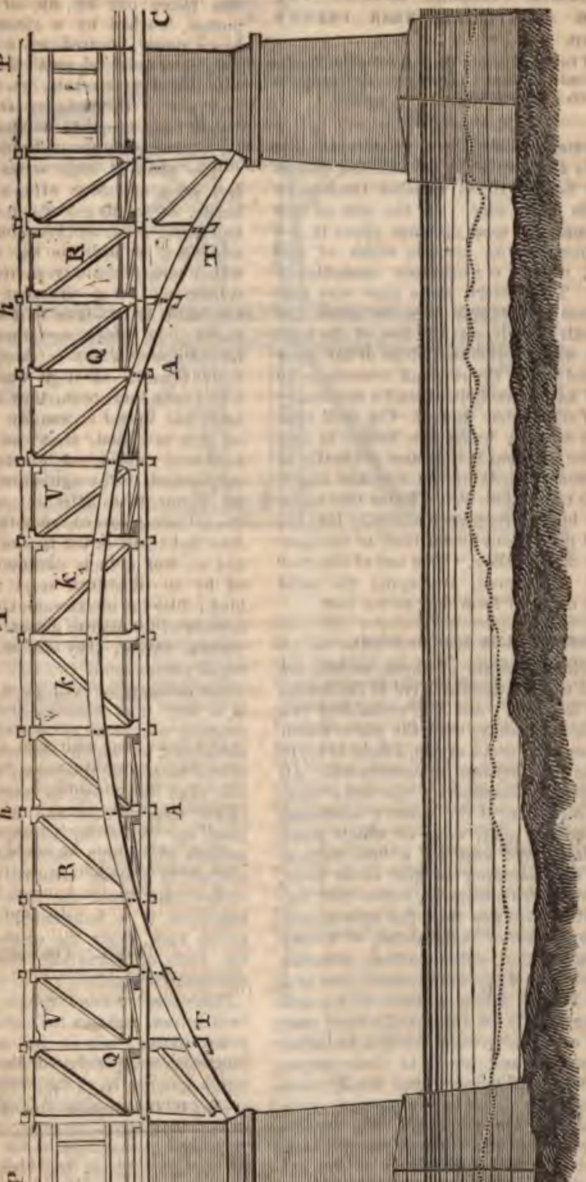


THE GREAT AMERICAN VIADUCT.

up-stream salient angle, was about eighty feet; their breadth thirty-four feet.

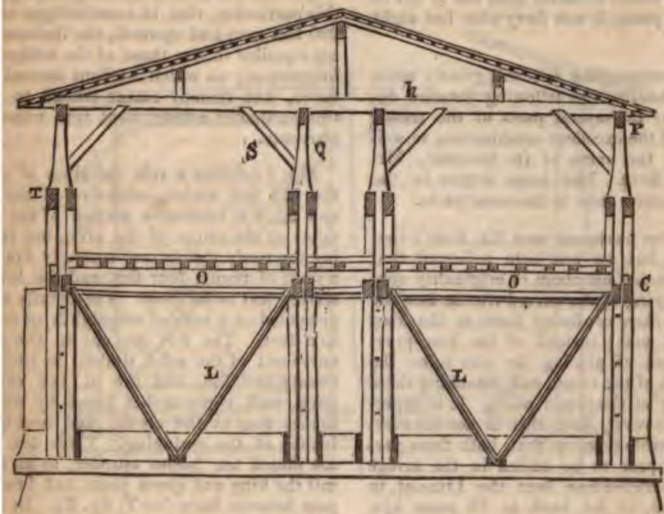
As each coffer dam was sunk, the water was taken out by six or eight common pumps, worked by a steam-engine of six-horse power, floated on a scow; and the rock after being cleared of the mud (which was raised in buckets, partly by windlass, and partly by handing it up successive stages,) was properly levelled and stepped off for receiving the foundations of the piers.

The piers at high water mark are sixty feet long, exclusive of the triangular pier heads, or starlings, and batter both below and above water at three-fourths of an inch to a foot, as high as the skew-back, from which spring the curved ribs of the superstructure. From the skew-back they rise vertically to the level of the chord pieces (see fig. 1), which rest upon them. Their height above water is thirty-five feet, and their breadth at high water twenty feet. The abutments are thirteen feet thick at their base, and batter externally three-fourths of an inch to a feet, that their faces may accord with those of the piers; internally they are vertical. The western wings form circular segments to a radius of fifty feet, their [illegible] being seventy-nine feet. They are [illegible] feet thick at the face of the abutments, and six feet at their extremities; they finish [illegible] flights of steps twenty-four feet [illegible] the abutments, they batter three-[illegible] an inch to a foot outside, and are [illegible] inside; they are surmounted by a [illegible] parapet wall two feet thick. The exterior masonry of both piers and abutments [illegible] very neat hammer-dressed rangework, [illegible] a system of alternate headers and stretchers, of which no course is less than [illegible] inches in thickness, nor any header [illegible] than three feet in length. The back-[illegible] both vertical and horizontal, are at [illegible] six inches in width, and are neatly [illegible] above high water, below which they [illegible] in Roman cement, extending eight [illegible] back from the face. The material [illegible] is a handsome, compact, gray, [illegible] rock, from the extensive quarries at [illegible] Falls of Schuylkill, distant two miles [illegible] the bridge.

The interior is of rough ruble, varying [illegible] eight or ten cubic feet down to [illegible] inches; laid in full mortar, and the [illegible] completely filled with liquid grout, which was run in as the work was raised, at every twelve or eighteen inches. The filling [illegible] principally from quarries of a very com-[illegible] black gneiss, opened for the purpose on [illegible] eastern edge of the river, at the imme-[illegible] site of the bridge.

No cramps or chains are inserted into any part of the masonry, it being considered that

Fig. 2.



ge dimensions of the face stones, and curacy of their joints, rendered such tions entirely superfluous. For hand- e stones, a long pole was planted in ier near its foundation, and supported ng crane, which was moved upwards as sonry proceeded, and finally was lifted ie top of the pole when the pier was ted, the pole itself being left enclosed stone work. The expense of removing fer-dams being considered greater than lue of the materials composing them, ere permitted to remain round the The total amount of masonry in the is 19,200 perches.

THE SUPERSTRUCTURE.

putting up of the timber work, which een already prepared on the ground, mmenced at the western end of the ; the abutment and piers on that side been finished some time in advance others. For this purpose a temporary l was erected, to support the wooden ructure; it consisted merely of slight , varying from twenty-five to sixty height; they were composed princi- f ten by twelve timbers, strengthened ry few transverse longitudinal braces, aced twenty feet apart. Their legs ınk *into the mud of the river* until their feet touched the rock. Notwithstanding the apparent lightness and insecurity of this scaffold, it not only sufficed to sustain the weight of the platform, but also resisted, effectually, the force of several considerable freshets, nor did any accident occur upon it for want of strength.

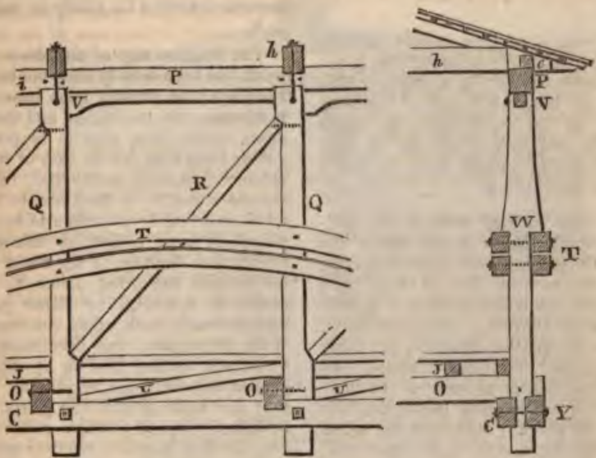
On the upper or transverse beams of these trestles were laid longitudinal timbers, extending from one to another, throughout the entire length of the scaffold; they supported the adjusting or raising blocks, which were merely short rough pieces of timber placed transversely on the top of each other to rectify any inequalities arising from the uneven bearings of the feet of the trestles.

Resting on the blocks, and also on the piers, were laid the chord pieces C, to which were applied and attached, in order, the queen posts Q, poles P, braces R, and the curved ribs T T; after which the scaffold was removed. The settlement consequent on this latter operation, did not amount to half an inch in any arch.

The straining-beams V and the straining-sills U, together with other secondary timbers, were not introduced till after the removal of the scaffold.

The bridge was originally intended for the accommodation of the rail-road traffic alone; but in anticipation of a proposed turnpike to

Fig. 3.



raining-beams V V, six by six square at eir smaller ends, and six by ten at their itts. At the feet of the queens are inclined raining sills, of plank five inches thick, by n wide. One end rests on the floor-girders, id the other on the chords (see U).

The queen braces R R, &c., are five inches ep by ten wide; the king braces *k k*, are the same width, but nine inches in depth; e heads and feet of both are mortised and noned, and spiked to the joggles of the ng and queen posts. The pole P is ten by elve. A transverse floor girder O, nine ches wide by fifteen deep, is placed behind ch queen, to which it is bolted. Every ird one of these girders is in a single piece tending entirely across the bridge. They l notch upon the chords, and support floor ists J, five inches wide by seven deep, aced two feet apart from centre to centre. n these joists are spiked, transversely of e bridge, the three inch planks, which, on e track appropriated to common travelling, rm the floor of the roadway; but which, i the railway track, support longitudinal rings of six by six, to which the iron rail rs are spiked. Between these strings is an lditional thickness of plank for the horse-ith.

Over each queen post, and notched upon *pole, is a transverse roof* girder, six inches wide by twelve deep, confined by long bolts to the heads of the queens (see *h*).

Horizontal diagonal braces, seven inches by seven, are tenoned in between every two consecutive girders, both in the roof and under the floor. They merely touch each other at their points of crossing, and are provided at their ends with wooden keys for forcing their tenons home into the mortises.

L L, in the transverse section, represent braces extending from the skew-backs of the piers and abutments, to the point of intersection of the chords with the third queen posts (A A, fig. 1).

At this point also, a wrought iron tie-bar, two inches in diameter, extends across the entire width of the bridge, and is confined by burrs at the outside of the chords.

The side braces S are of oak, four by five inches, mortised, tenoned, and spiked to the queens and to the roof girders. With the exception of these and the shingles, all the timber of the superstructure (amounting to one million and eight hundred thousand feet, broad measure,) is of white pine, from the shores of the Susquehanna. All of it that shows above the floor is planed; all below is rough; none of it is finished with that degree of nicety which would have been ne-

cessary had the bridge been in the immediate vicinity of the city. One hundred and sixty thousand shingles, of Carolina cedar, laid in nine inch courses, were required to cover the roof.

The total weight of iron worked into the timber is, cast, six tons; wrought, ten tons; the former consisting of the abutting plates for the ribs and braces L L, and of the burrs and washers for the screw bolts; the latter of screw bolts and spikes, and the tie-bars under the floor, at intersections of braces L L, with the chord pieces.

The time that elapsed between the delivery of the rough timber at the site of the bridge, and the passing over of the first cars, was only three months, but at that time neither the roof, flooring for common travelling, nor weather-boarding were commenced. The studs for the weather-boarding are three inches by four, and are placed vertically, two feet apart, from centre to centre. At their lower ends they are notched two-and-a-half inches upon the chords; higher up the notch slightly on the ribs, and at their upper ends tenon into the projecting feet of the small rafters of the roof, which, for that purpose, are also placed two feet apart. The small rafters foot upon the longitudinal piece *e*, four inches by four, spiked on the upper side of the pole P. The projection of the eaves extends two feet six inches beyond the outer line of the queen posts. The weather-boarding is in horizontal courses of three-fourths inch plank, planed on both sides; not tongued and grooved into each other, but merely laid overlapping. No part of the studs or weather-boarding is shown in the drawing. The bridge is lighted by large Venetian windows at the sides, two over each pier; and by two sky-lights over the centre of each span. The superstructure was executed by Jno. P. Babb, of Wilkesbarre, Pennsylvania, by a sub-contract, under the principals, Dodd, Bishop, and Brittain, who directed their attention more particularly to the masonry. The general superintendence of the work, on the part of the state, was intrusted to Mr. Frederick Erdman, a gentleman whose extensive practice, and uniform success, in important mechanical undertakings, had rendered him particularly eligible to that duty.

CONCLUDING REMARKS.

Burr's plan for wooden bridges is perhaps the best now in use; and that at Peter's Island is probably the most correctly proportioned of any yet constructed on that principle.

It is proper, however, to exhibit the defects as well as the excellencies of this important work. They fortunately are very few, and will detract in no sensible degree from the general character for utility so justly ascribed to it.

The insufficiency of the floor-girders and joists has been already adverted to. The clear bearing of the former, from chord to chord, is nineteen feet ten inches, and their distance apart varies from nine to twelve feet; any one of them may, in the case of two heavily-laden cars passing each other, be obliged to sustain a weight of from six to eight tons, which is certainly too much to be placed on a girder of nine inches by fifteen, and of twenty feet bearing, if the beam is required not to bend somewhat under it. This may easily be remedied by either placing the girders nearer each other, without reference to the queen posts, and permitting the joists to remain as they are; or by retaining the present intervals, and employing larger timbers for both girders and joists. It would be difficult to procure single pieces sufficiently deep for that purpose, but they might readily be constructed of two beams in depth, firmly connected together. The same defect exists in the before-mentioned bridge at Market-street. The clear bearings of the girders are there eighteen feet; their distance apart the same; and their dimensions fourteen inches broad by seventeen deep; it was, after some time, found necessary to adopt precautions for strengthening them. Again, the height of the bottom of the roof girders above the rails is but twelve feet; it would have been more agreeable to outside passengers, on high cars, if it had been thirteen or fourteen feet.

The crossing of the stream obliquely, is, when considered in the abstract, a fault of considerable importance; but in this case it was rendered necessary by overruling circumstances, which it would be foreign from the subject to dilate upon at present.

The foot-path should have been at least six feet wide.

Lastly, the starlings, or pier-heads, to be perfectly effective, should have been carried considerably higher above the surface of the water. Their use is principally tested in times of ice floods, by dividing the ice, and forcing it to glance off from the angles of the piers. But, as they now are, a broad pier face is opposed to the current, whenever the water rises rather higher than usual; and by obstructing the passage of the ice, is calculated to heap it up, and, thereby damming the stream, to endanger the safety of the whole bridge.

THE FISHERMAN'S LAMP A MODERN ANTIQUE.

Sir,—Having by chance met with a book, published just 200 years past, I was amused by observing in the title-plate, which in old books generally shows in miniature those things considered the most curious in the work, a simple fisherman's lamp; and as some of your readers may probably like to know what their great, great, great-grandfathers thought on subjects brought forward at the present time, I have traced the wood-cut, which I now send you with the description. The book is entitled, "The Mysteries of Nature and Art, by J. B.", imprinted for Ralph Mab, Cheapside, 1634, and has Sir Hugh Plat's "Jewel House of Art and Nature," printed in Grub-street, 1653, bound up with it.

I remain, Sir,

Yours respectfully,

James R. White.

Wells, Somerset, Sept. 12, 1834.

"*How to make a light burne under the water, being a very pretty conceypt to take fish :—*

"Let there be a glasse, as A, having a hole at the bottome, to put a candle in with a screwed socket. The socket must have a loope at the bottome, whereunto you must hang a weight of such heavinesse, that it may draw the body of the glasse under water. The necke of this glasse must bee open, and stand above the water; also about the necke must bee fastened a good broad peece of wood; round about which (but on that side of it that is next unto the water), must bee placed divers peeces of looking-glasses; so the light of the candle in the glasse body will bee multiplied according unto the number of them. All the fishes neere unto it will resort about it, as amazed at so glorious a sight, so you may take them with a cast-net or other."

CHILDREN CHIMNEY-SWEEPERS—FOURTH LETTER.

Sir,—To come now to the sufferings of climbing children.

Before I proceed to make extracts from the two sets of evidence (for I shall say nothing but from the evidence), let me anticipate that I shall be met by the observation—"the children cannot be ill-used, they look so happy." Why, yes; one of the benign arrangements of Providence is to bestow upon childhood a buoyancy which enables it quickly to throw off the remembrance of pain and sorrow. Childhood is free from the pride which encumbers us in after life, and which acutely feels the smart long after the body has wholly ceased to feel it. I shall be told, too, that the condition of the children has of late years been improved, and that the masters treat them better than they did. I should be very sorry to leave the children to the tender mercies of the masters (with some few exceptions), unless the strong arm of the law and the menacing eye of the public were present for their protection. The phraseology ought to be, that "their condition is less outrageously bad than it was"—"that their masters dare not treat them so brutally ill as they did." This is strong language; it will be borne out before this letter is ended. But let the children look as playful as they may, let the master treat them as well as he can, I must insist that the employing of children for cleansing chimneys is a very cruel practice. As to Acts of Parliament, if there is a possibility of evading them, the masters will not be long in finding it out; and if they cannot evade they will break them.

I now proceed to make extracts from the evidence, for brevity sometimes omitting the question, sometimes an unimportant part of the answer:—"The skin was off my knees, and elbows too, in climbing up the new chimneys they forced me up."—"When I got up I cried about my sore knees."—"When I went to a narrow chimney, if I could not do it, I dare not go home; when I used to come down, my master would well beat me with the brush; and not only my master, but when we used to go with the journeymen, if we could not do it, they used to hit us three or four times with the brush."—"I climbed the chimneys with a great swelling on my knee, which came of itself."—"If I go out with a journeyman in the morning, if I have got bad chilblains, and if I cannot get on fast enough, I must off with my shoes, or they will knock me down with their hand; and I must run through the snow without shoes, which I have done many times."—"How often are they washed?" "Sometimes every week, and sometimes every fortnight, and sometimes not more than once a year. A great many masters, if they have got a new suit of clothes for them, the mistresses, to get a drop of any thing to drink, will go and pawn the clothes; and then, when Sunday comes, 'My man, you must have a dose of physic, you are not well;' and so they do not want their clothes."—"Do you know of the boys being subject to any accidents?"—"I have known one at Temple-bar; I came myself and went to him, but it was too late; the boy was lost through a woman forcing him up, it was his mistress." All these answers were given by one master chimney-sweeper. He speaks also of the lowest age at which he had known a child to be employed in sweeping, viz. five years—and of female children being so employed.

The same witness being asked, "Am I to understand you that the severity exercised towards these boys does not arise from the difficulty of performing their work, but from the wanton cruelty of those placed over them?" answers—"Yes; there are chimneys on fire sometimes; when you go, may be there may be a good-hearted boy, the same as I have been myself, and I have scars to show it, one on my chin, another on my breast, and several others; there may be a down-hearted boy, he will come crying, and will not do it, he is smacked up against the fire-place and worked with a stick: then they will come and fetch me; may be I may do it, then that boy gets ill-used; I may burn my shirt, or burn my cap, or my breeches, but that boy is sure to get ill-used; so that they force us up the chimney; we are obliged to do it, whether or not: there is a kitchen chimney, No. —, ——street, Holborn, was on fire three times; then I went again the third time, and there was a great hole in it where the beam came through, and the boys, because it was so narrow, were

afraid to pull it down, I pulled it down, and it got into my leather breeches, and burned my thighs and my body, and I had blisters, so that I could not walk for a fortnight, and Mr. ——, the doctor, in ——-street, knows that."

There is a great deal more in the evidence of this, the first witness, which I should like to extract, relative to the head of suffering, but I must not forget to spare your space.

Perhaps the next piece of evidence may render it unnecessary for me to pursue this painful subject further. It is, as printed, a copy of the inquisition taken before the coroner, touching the death of a boy, Robert Dowland, in October, 1817. I have, for the sake of brevity, struck out some passages that may well be omitted. I do not believe the master, in this case, had any malice; he was no exception from the general body; he was merely a fair sample of ignorant brutality, a specimen of a class of persons who, having been brought up in ignorance and under constant ill-treatment, are, when they become masters themselves, quite incapable of properly managing those who may be unfortunate enough to come within their power.

"Ann Bishop, wife of Alexander Bishop, has seen the deceased before his death, by coming into the shop; the deceased was a sweep about twelve years of age. On Tuesday morning last, between eight and nine o'clock, he came into witness's shop for a stale roll; he was apparently in his usual state of health: he came to sweep the witness's chimney: his master came with two others. His master directed the boy to go up the flue of an oven, which had been built about three weeks or a month: he went up the flue and came down again, and he had grazed or burnt his arm. There had been before fire in the furnace to heat the oven, but the flue had not been on fire. Witness heard the boy complain of his arm, and that it smarted very much. He went up the flue of the old oven afterwards. Was not in the bakehouse at the time he went up. He continued in the flue nearly upon an hour. After he had been up about a quarter of an hour in the flue of the new oven, witness finding him continue so long up, witness asked if there was any danger; he said he was sulky and taking a nap. The fire had been out about four hours when the boy came to sweep it. When the boy had been *up about an hour,* witness again asked the master if there was any danger, she having heard the boy crying; when he said there was no danger, as he was hung to a nail. The boy had been up to the top of the chimney, and had come down the upright part of the chimney again, into a slant* where there was great quantities of soot, so that there was a difficulty of getting hold of him again. The flue was opened a little above the shop floor, where the boy was taken out from amidst the soot, which was all around and about him. Believes he was then quite dead. Medical assistance was sent for; he was taken into the garden, into the air, and from thence into the parlour again; he was washed with hot spirits by the doctor, but he never moved or spoke afterwards, to the witness's knowledge. When the boy came out of the flue of the new oven, his master said he ought to have had a good thrashing for staying up so long. The boy was very much exhausted when he came out of the flue of the new oven, and the apprentice boy gave him some cold water to wash his mouth. One of the other sweeps attempted to go up the flue of the old oven, but he said it was too small for him to go up. The deceased was sent up when he came down the flue of the new chimney. The witness observed, that he had treated the boy harshly; and he said, he knew his business. When the boy was sent up the old flue, the master said, if he was behind him he would make him go up a little quicker. When the boy was up, witness asked if the flue would not be too hot for the boy; the master said it was not too hot. The fire had been out from about four o'clock. The oven would bake a joint of meat after the bread is taken out. There were potatoes baking in the oven at the time the boy was up the flue. The boy was within four feet of the oven when the flue was opened. The master thought there was no danger, and that there was no occasion to break into the flue. Witness heard his cry very low: the master said he had sent for another boy to assist him. The master sweep, —— ——, was present all the time the boy was up the two flues. From the time of the witness first hearing the boy cry, till the time of his being taken out, might be about a quarter of an hour. The boy's cries seemed to proceed from the same part of the flue during the whole of the time that the witness heard him, before witness thought the boy had been too long in the chimney before she heard the boy cry, was the first occasion of her asking the questions of the master. The witness's husband broke down the part of the flue where the boy was, which

* A slant, in the language of the chimney-sweepers, means a horizontal chimney, or flue; an inclined flue, or chimney, they would call a slope.

was full of soot; the master sweep thinking there was no danger.

"Thomas Smith, bricklayer.—Witness was sent for between the hours of nine and ten o'clock on Tuesday last; when witness came, he was informed the boy was in the flue, and Mr. Bishop had with a poker broke away part of the flue; the boy's head was level with the shop-floor; when the bricks and rubbish were removed, the boy was quite covered with soot; and a bushel and a half of soot was taken out of that part of the chimney where the boy was. The boy was apparently dead; there were no symptoms of life at all. The part of the flue where the boy was, was exceedingly hot, through the stoppage, so that the skin was so scorched as to slip up with the witness's hand when he attempted to get him out; and witness let him go lest he should hurt him if he was alive. Witness had great difficulty in getting him out; he was so wedged in, that witness pulled at him ten or twelve times before he could get him out. It was about ten o'clock when the witness got him out, and the flue at that time was exceeding hot. The master did not seem very anxious, and did not exert himself so much as he might; but whether from ignorance or inattention witness cannot say. Witness thinks he might himself have got so far up the flue, as to have got the boy out by the feet before the flue was broken into. The flue is about fourteen inches by twelve; there is a pinch near the turn of the chimney.

"Daniel Mead, servant to Mr. Bishop.—On Tuesday last, about half-past three o'clock, the fire was taken from the old oven; the sweeps came about a quarter before eight o'clock. The boy went up the new flue first. Witness was present when he came down; he was very hot indeed; witness's fellow-servant brought him some water; he sweat very much, and seemed very faint. When he came down the first flue, the master said he ought to have a d—d good hiding, because he was so long; he did not beat him. No one attempted to go up the old chimney before the deceased went up. The master told him to make as much haste as he could. He was a long time going up. Heard him come down as low as the shop; heard him cry out he was hung to a nail; heard him crying and sobbing very much, very near nine o'clock, having been up about twenty minutes; never heard any more. Witness went to bed, leaving him up the chimney. Upon asking the boy's master, he said there was no danger in the least. He heard the boy cry out a great many times, and sent *another boy up after him*; he went as far as *he could reach his toes; the* child said he *could not pull him down*—'He won't come down, master,' who said, 'D—n him, let him stop.'

"Alexander Bishop.—Was out when the sweeps came: returned about ten o'clock, not knowing the sweeps had been there. There were several persons in his shop, who informed him a boy was stuck in the flue: the master said he was in the slant behind the shop-door. Witness began to cut away, when the master said, 'Don't cut away, you are too hasty.' Heard the boy drawing his breath very hard, as if he was drawing his last. Told him he wished he was where the boy was, for permitting the boy to remain there, whether he was right or whether he was wrong. His head was amongst the soot, which witness cleared away. The master said he was lying there taking half an hour's nap. 'He is sulky; let me get up to him; when he hears my voice he will come out.' The master did not, in witness's opinion, properly exert himself; whether he acted from ignorance or inhumanity, witness cannot say."

Now, setting aside all our sensitiveness, and looking at the matter as coolly and as stoically as we may, can any one say that we ought not to use every exertion to prevent the possibility of any repetition of this most melancholy tragedy?

I am, Sir,
Your obedient servant,
ARCHIBALD ROSSER.

15, New Boswell-court,
Sept. 17, 1834.

THE LATE MECHANICS' INSTITUTE.

Sir,—As this Institute is taken out of the hands of the mechanics, I wish to know in whose hands the property is legally vested. As a friend to the arts and artisans, I made, in the infancy of the Institution, what, in the letter of acknowledgment, was stated to be "a splendid present of books." Now, as this present was intended solely for the mechanical members, I do not conceive that their successors can have any right to retain them. I, of course, do not wish them to be returned to me, but I do wish them to be placed in a library where they would be useful, as I do not apprehend that treatises on the laws of motion have any thing to do with motions in court, the proper study of the majority of the present members.

Yours truly,
J. B.

London, Sept. 6, 1834.

MATHEMATICAL INSTRUMENTS.

Among the difficulties in the way of those who desire to cultivate science experimentally, one of the greatest is a want of practical acquaintance with philosophical instruments. There are a great many more persons who can tell what the uses of a theodolite, or transit instrument, are, than could tell the one from the other, if set before them, far less how to handle them to any purpose. It is a difficulty, too, felt by none so much as by the solitary searcher after knowledge—the self-taught and self-directed—who, of all searchers, is commonly in the end the most thriving and successful. After acquiring from books a theoretical knowledge of any department of science, the moment he attempts to reduce his knowledge to practice that moment books fail him; he finds that he has advanced to a point, beyond which he must look to quite other sources for information and assistance. Exceptions there are of course—we speak only of scientific pursuits in the general. Mr. Farraday, for example, has, by his work on "Chemical Manipulation," nearly removed every such difficulty from out the path of the chemical student. But how many such helps to practice are there? How many works professing to be of that character, which but remind one of the folly of the blind pretending to lead the blind?

There are few departments in which this deficiency of book-knowledge has been more felt than practical astronomy and field-engineering—the former more especially. The instruments indispensable to the practice of them are numerous—most of them of a very complex and delicate description, requiring the nicest possible adjustments—and some of them so extremely expensive as to come rarely under common observation. But though they have been all described somewhere or other, they have not always been well described, and the descriptions, such as they are, lie scattered about—often in very out-of-the-way places. What a beginner in either department wanted he could find no where—namely, a book of instruments, or manual of practice, describing *in plain and familiar* language all the *standard instruments*, and the manner of using them, yet so briefly withal, as to be at the same time both cheap and portable.

We are happy to see at length before us a book which has for its express object to supply this want;* written, too, by a gentleman (Mr. F. W. Simms) who possesses every practical qualification for the task, having been for some time employed on the great Ordnance Survey, and being now assistant at the Royal Observatory, Greenwich.

The first branch of the work is devoted to "Surveying Instruments," and includes very full and satisfactory descriptions of the Land Chain, the Surveying Cross and Optical Square, the Prismatic Compass, the Vernier, the Theodolite and Plane-table. Since the invention of the Theodolite, the Plane-table, which is of the rule o' thumb days, has gone much out of use; nor would any well informed surveyor think of now employing it on a survey of large extent, or where great accuracy is required. There are still, however, many cases in which it may be used with perfect propriety, and, so far as expedition is concerned, with advantage—in surveying, for example, small plots of ground, or in forming rough sketch maps, or in laying down the details of a country where the relative situations of the principal conspicuous objects have been previously fixed by triangulation. A surveyor may also be occasionally so situated as to be obliged from necessity to use it; he may not have his theodolite with him, or his theodolite may be out of order. Although, therefore, not *so much* employed as formerly, the plane-table is, in point of fact, still very extensively in use, though, at best, but of approximative accuracy. To those with whom it continues a favourite, the following extract will convey some useful hints:—

"In preparing the plane-table for use, the first thing to be done is to cover it with drawing-paper; the usual method of doing which is the same as that of covering a common drawing-board, by damping the under side of the paper, and laying it on

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* A Treatise on the Principal Mathematical Instruments employed in Surveying, Levelling, and Astronomy; explaining their Construction, Adjustments, and Use. With an Appendix and Tables. By Fred. W. Simms. 108 pp. 8vo. Troughton and Simms, 1834.

the board in an expanded state; press the frame into its place, so that the paper may be squeezed in between the frame and the edge of the table; and the paper shrinking as it dries assumes a flat surface for the work to be performed upon. There is one great objection, however, to this mode of putting on the paper, as when it has once been damped and strained, it is easily acted upon by any change in the hygrometrical state of the atmosphere. We, therefore, prefer putting on the paper dry, taking care to keep it straight and smooth whilst pressing the frame into its place; but it must be acknowledged that this cannot be done so nicely as when it is damped. We have been informed, that if the under side of the paper be covered with the white of an egg well beat up it may be laid on the board with the greatest nicety, and that when so prepared it is not easily affected by atmospheric changes.

"When the survey has been carried to the edge of the paper on the table, and there is occasion to extend the operation further, another sheet must be substituted; but before removing the old one, a line should be drawn on it through some particular stations or points of the survey that can be made common to both sheets of paper; then, by drawing a similar line upon the new sheet, and transferring to this line the points or stations that are upon the line in the former sheet, as well as the direction of the last station lines, the survey may be renewed, and continued in the same manner from sheet to sheet till the whole is completed. In drawing the corresponding line upon the second sheet, it is necessary to pay due regard to the general direction of the future survey, that the line may be so drawn as to admit the greatest possible quantity of work into each sheet of paper.

"Such is the description of the plane-table as formerly and as now generally constructed; but for our own use we would dispense with the graduations on the box-wood frame altogether, except, *perhaps*, those of equal parts, which are sometimes useful when shifting the paper. Indeed, in our method of using the instrument, a plain board, made of well-seasoned but soft wood (as pine or cedar) to admit readily of a fine pin or needle being fixed in it, would, with the compass-box, answer every purpose; as we should prefer pasting or glueing a thick sheet of drawing-paper, or fine pasteboard, over the surface of the latter, as the errors caused by changes in the moisture of the air would be greatly diminished. A fair copy of the plane can be afterwards made out at leisure, and if one board is not sufficient to contain the whole of the survey, others, similarly prepared and adapted to the same staff-head, may be provided to continue the work."—pp. 18, 19.

Next follows "Levelling Instruments," including the whole practice of levelling, whether with the ordinary Y spirit level and staves, or with Mr. Troughton's improved level and staves, or with the mountain barometer. The determination of altitudes by the barometer, Mr. Simms has rendered singularly easy, by means of a table which he has computed according to the formula furnished by Mr. Bailly in his Astronomical Tables. It is similar to Mr. Bailly's own table for the purpose (XXXVI.), but more extended. Mr. Simms gives, as an example of the accuracy with which levelling may be performed by means of the barometer, the results of some observations which were made to ascertain the difference of altitude between the transit-room of the Royal Observatory, Greenwich, and the base of the statue of George II., in Greenwich Hospital. The difference, as ascertained by the barometer, was 136.46 feet, by the spirit level, 135.57—the two results varying only to the eighty-ninth part of a foot.

Mr. Simms gives, by way of Supplement to the Surveying and Levelling sections of his work (though dismissed, for no good reason that we can perceive, to the Appendix), an account of the most approved methods of protracting angles, and plotting and performing road surveys, with descriptions of the circular protractor, plotting scale, station pointer, &c. We look upon this portion of the work, notwithstanding the subordinate position assigned to it, to be one of the best; it is admirably minute and clear, and contains much essential information which we do not remember to have met with any where else.

We may also notice here, as connected with surveying and levelling, a description of that very useful little instrument the box sextant, which is given somewhat out of place among the "Astronomical Instruments"—not so much, however, on account of the description itself, which offers nothing remarkable, as of the concluding paragraph, which brings, for the first time, to our knowledge the invention of a very ingenious and valuable addition to the instrument.

"Since writing the above, we have been shown, by a professional gentleman, an excellent contrivance for taking altitudes or depressions with the box sextant, which consists of two small spirit levels fixed at the back of the horizon glass, at right angles to each other, so that, standing before the object, you look perpendicularly down through the plane sight, and moving the index bring the image of the object to appear with the levels, which must have their air-bubbles in the centre of their tubes. The reading of the instruments will then show the supplement of the zenith distance, and its complement to 90° will be the angle required, elevated if more than 90°, and depressed if less than 90°."—p. 46.

The division which treats of "Astronomical Instruments" is the largest of the work. We have first the Sextant and its uses described (that most extensively useful of all astronomical instruments, so much so, that it has with great truth been said to be "in itself a portable observatory"); then Troughton's Reflecting Circle, which is, in principle and use, similar to the Sextant; Artificial Horizons of every variety; and next—passing over the Box Sextant, of which we have already spoken—the Dip Sector, of which there is the following anecdote:—

"When the late Professor Vince was engaged in making observations upon extraordinary refraction at Ramsgate, Mr. Troughton contrived and constructed for his use an instrument which he called a Refraction Sector. About five years afterwards, when preparations were making for the first of the late North Polar expeditions, Mr. Troughton was applied to by the late Dr. Woollaston to make him an instrument, on the principle of the back observation with the quadrant, to send with the expedition to measure the dip of the horizons; but upon Mr. Troughton's producing his Refraction Sector, which was as well adapted to Dr. Woollaston's purpose as that for which it was devised, the Doctor immediately ordered one to be made for him, and named it a Dip Sector; proposing, at the same time, an improvement in the construction of the handle, which, on his suggestion, was made to turn on a centre, to be placed in any position for convenience in use, or packing in its case; that made for Dr. Vince having two fixed handles at right angles to the force of the instrument."—p. 48.

Following the Dip Sector comes the Portable Transit Instrument, with an example of the Greenwich mode of registering transit observations. Alluding to the frequent employment of this instrument for purposes to which it is not adapted, Mr. Simms makes the following just observations:—

"In *some*) regular observatories the transit instrument is employed not only for the determination of time, but in forming catalogues of the right ascensions of the fixed stars, and other important operations in astronomy; purposes for which instruments of a superior class, and fixed in their respective places, are required. But from the small size, and low optical power, of the portable transit instrument, it can be applied with good effect only to the determination of time, and of the longitude by observations of the moon and culminating stars. The Nautical Almanac (now) contains the true apparent right ascension of the sun, and of 100 of the principal fixed stars; that is, the sidereal time, when each of them respectively is on the meridian, or on the centre wire of a properly adjusted transit instrument; and if, the instant when a star so passes, the central wires be noted by a clock correctly adjusted to sidereal time, the time shown by the clock will be the right ascension of the star, as given in the Almanac. The difference, therefore, between the time shown by a clock and such right ascension will be the error of the clock from sidereal time (or too fast), when the clock time is greater than the right ascension, and—or too slow when it is less."—p. 62.

There is a method of finding the latitude (as well as longitude), by means of the transit instrument, which was first pointed out by Professor Bessel, and has been used, we understand, with great success in the Russian trigonometrical survey. Mr. Simms explains this method in detail, and gives it as his opinion, that, with proper precautions, and a level of the best kind, the latitude may be obtained by it "within a second or two, when the place of the star is sufficiently well known," and "*differences* of latitude whether the star be known or not."

The Altitude and Azimuth Instrument—its construction and many valuable uses—occupy the remainder of the astronomical division. Mr. Simms quotes from a paper of Mr. Troughton's, in the "Memoirs of the Astronomical

Society," the following ingenious method of making foot screws:—

"Each of the three screws is double, that is, a screw within a screw: the exterior one, as usual, has its female in the end of the tripod, and the female of the interior screw is within the exterior; the interior one is longer than the other, its flat end rests on a small cup on the top of the support, and its milled head is a little above the other. Now by this arrangement we gain three distinct motions, for by turning both screws together an effect is produced equal to the natural range of the exterior screw; by turning the interior one alone the effect produced is what is due to this screw; and by turning the exterior one alone (which may be done, because the friction of the interior screw in the cup is greater than that which exists between the two screws), an effect is produced equal to the difference of the ranges of the two screws. Thus were the exterior one to have 30 turns in an inch, and the interior 40, the effect last described will be exactly equal to what would be produced by a simple screw of 120 threads in an inch."—p. 73.

Besides the Table we have mentioned, for determining Altitudes with the Barometer, the Appendix contains a Table for reducing the Apparent to the True Level—two others for Converting Intervals of Sidereal into corresponding Intervals of Mean Solar Time, and, *vice versa*,—two more for Computing the Longitude from the Observed Transits of the Moon, and Moon Culminating Stars—one for Computing the Reduction to the Meridian—and another showing the Length of a Second of Longitude and Latitude in English Feet, for different latitudes—all very useful Tables, the two last entirely new.

Mr. Simms's instructions for the various computations required in astronomical practice, have one common feature, which we think particularly deserving of praise. He first shows how each computation is to be made according to the established formula, which is invariably in the algebraic form; and then, for the sake of persons who may be unacquainted with algebraic notation, or are inexpert in the use of it, he throws the formula into the form of a practical rule, which any person acquainted with the lesser geometry, or even with common arithmetic, may readily understand.

We must not forget to mention one *other valuable feature of* Mr. Simms's work—and that is, the numerous woodcuts by which it is illustrated. Of nearly all the instruments described, there are engravings—executed not certainly in the first style of xylography, but superior to most engravings of the same sort, in this respect, that they have been executed under the eye of two of the most distinguished makers in England of the articles represented (Messrs. Troughton and Simms), and may be, therefore, fairly presumed to be more than usually accurate.

When we consider, further, the singularly low price (only 5*s.*) at which the work is published, we feel that we should be much wanting in justice to the author, did we not conclude with most earnestly recommending it to the favour of our readers. We cannot conceal from ourselves, and must not conceal from the author, that full justice to the subject of the work requires that a good many additions should be made to it. Telescopes, for example, should be treated of more at large, and the effect of optical influences on geodesical operations not so entirely overlooked. Something, too, of grinding and polishing specula, and also of instrumental arithmetic, would be extremely acceptable. The work, however, wants nothing which may not be easily supplied in future editions (of which we doubt not we shall see many), and, as it is, it would be difficult to over-rate the service it is calculated to render to practical science.

LIST OF NEW PATENTS, GRANTED BETWEEN THE 22D OF AUGUST, AND THE 22D OF SEPTEMBER, 1834.

John Beard, of Leonard Stanley, Gloucester, for improvements in machinery for dressing woollen cloth. Sept. 1; six months to specify.

George Joseph Green, John Ogden Bacchus, and William Gammon, of Birmingham, glass manufacturers, for improvements in the manufacture and working of plate, and other glass, communicated by a foreigner residing abroad. Sept. 1; six months to specify.

John Chanter, of Stamford-street, Surrey, and of Earl-street, Blackfriars, London, gentleman, for an improvement in furnaces. Sept. 2; six months to specify.

John Joseph Charles Sheridan, of Walworth, chemist, for certain improvements in the several processes of saccharine, vinous, and acetous fermentation. Sept. 6; six months to specify.

William Longfield, of Otley, York, whitesmith, for an improved lock or fastening for doors and other situations where security is required. Sept. 6; six months to specify.

Henry Shrapnel, of Salisbury, major-general and colonel in the Royal Artillery, for improvements in fire-arms of various descriptions, and in ammunition for the purposes of fire-arms. Sept. 6; six months to specify.

Miles Berry, of 66, Chancery-lane, civil engineer, for certain improvements in mills for grinding wheat and other grain, and which improvements render them also applicable to other purposes, being a communication from a foreigner residing abroad. Sept. 13; six months to specify.

Stephen Perry, of Wilmington-street, Wilmington-square, gentleman, and Edward Massey, senior, of King-street, Clerkenwell, watch-manufacturer, and Paul Joseph Gauci, of North-crescent, Bedford-square, artist, all in the county of Middlesex, for certain improvements in pens and pen-holders. Sept. 20; six months to specify.

Edward Weeks, of King's-road, Chelsea, horticultural builder, for certain improvements on kitchen or other grates or ranges, which he denominates Weeks's Cooking Apparatus. Sept. 20; six months to specify.

NOTES AND NOTICES.

M. Arago, the French astronomer royal, who attended the meeting of the British Association at Edinburgh last week, has been commissioned by his Government to entirely remodel the *Observatoire Royale* at Paris, and his journey to this country has been partly for the purpose of communicating personally with our astronomer royal, Mr. Pond, and to examine the very important, but little talked of, improvements in astronomical instruments which the Greenwich Observatory now exhibits; as well as to become acquainted with the superior manner of observing practised there. M. Arago has expressed, in the most unequivocal terms, his admiration of all he has seen at Greenwich; he fully concurs in the praises which the most celebrated German astronomers have bestowed on the mode of conducting the business in our observatory; and acknowledges the beneficial results to nautical science which have flowed from the system there adopted, which originated with, and has been perfected by our present astronomer royal.—*Globe.*

Telegraphic Communication between London and Liverpool.—We have heard that there is some idea of forming a line of telegraphs along the London and Birmingham Railway as far as Birmingham, and though no arrangements have yet been made for carrying the project into effect, we entertain hopes that it will not be allowed to die away, and that the line, instead of being permitted to terminate at Birmingham, will be extended to this town, in which case the communication of important intelligence may be effected between London and Liverpool in a wonderfully short period of time. The reason why it has been proposed to connect the line of telegraphs with the railway is that it may frequently be necessary (as in the case of an engine with a train of passengers getting out of order), to communicate rapidly along a distance of several miles, for the purpose of obtaining assistance. The primary object, therefore, is the convenience of the Railway Company, and it is believed that the straight and level lines of the railway, some of which extend without a curve for several miles, may be used for this purpose, with almost as much advantage as a chain of heights and headlands. If the plan should be carried into effect, however, the accommodation of the company will soon be a very secondary object, and the telegraph will become an important political and commercial instrument, valuable in peace, and doubly valuable in time of war. In France there are telegraphs from Paris to the Spanish, the Italian, the German, and the Belgic frontiers, as well as to Calais, Brest, Marseilles, and Toulon; whilst in this country, so much a-head of France in most of the arts of life, the only line in use is that from Liverpool to Holyhead, the one from London to Portsmouth, employed during the war, being no longer in operation. Even the Prussian Government has formed a line of telegraphs between the Rhine and Berlin. In general the spirit and enterprise of British capitalists have been found much more effectual in opening new and improved lines of communication between all parts of this country than the patronage of Government has been on the Continent; but in this respect we are behind most of the Continental nations. This probably arises from the fact of telegraphs having been principally used for military purposes, especially during the reign of Napoleon; but there can be no doubt that they may be rendered extremely useful in conveying commercial, shipping, and general information, as well as Government orders in time of peace, and that they would become of immense value if we should ever have again the misfortune to be involved in a war.—*Liverpool Times.*

If Mr. Baddeley will refer to the drawing of Mr. Barton's piston, contained in "Galloway's History of the Steam-Engine," page 437, he will there see one of Mr. Barton's improved pistons, in which the light circular steel hoop is alone used, the spiral spring being wholly laid aside. Mr. Baddeley, in No. 564, refers to Barton's piston of 1818, not 1828 or 1830, which is not quite fair to Mr. Barton.—James R. White, *Sept.* 12, 1834.

Cotton Weaving.—An invention is in course of trial, at Wallshaw Mills, Oldham, which has for its aim the adaptation of the Jacquard silk figuring loom to the figuring of strong cottons; and John Fielden, Esq., one of the honourable members for Oldham, has so far improved the power-loom, that, by a new application of the lathe, it will perform nearly double the quantity of work now produced.—*Macclesfield Courier.*

Our readers will be gratified to learn, that the inquiry and observations we made respecting the necessity of employing a tinker to design and finish the tops of the chimneys of the new State Paper Office (vol. xx. p. 336), have not been without their use. The long metal tubes have been taken down, and the chimney-tops have been again neatly and ornamentally finished in stone. This example, which cannot be too much admired, it is hoped will be followed by other architects who have the superintendence of public buildings, and that they will at once use their best efforts to dismount every cowl, tall boy, and potters' chimney-pot, from the prominent situations so many of them occupy, and there appear as blots on the tablet of the sky. Grenadier caps surmount Apsley-house, while on St. George's-hospital, which stands on lower ground, no such useless terminations to the chimneys have been permitted. We will thank our readers to acquaint us (if by letter, post paid), when any such tenants are removed, either from public buildings, or noble private dwellings; and perhaps they will also favour us with a description of any new character given to chimney-tops. We hope the taste displayed in the chimneys and manufactories, which we lately noticed, will contribute to forward improvements in the appearance of those on every other building.

Perhaps many of our readers are aware, that, on either side of the York Monument, Carlton-terrace, there are gates, and that these are constantly open during the day, and sufficiently wide for any carriage to pass through. In fact they appear, from Waterloo-place, evidently intended for carriage

entrances, for the trees in the Park may be seen through the openings, but not the thirty-six steps which descend from the base of the pillar. There is not, perhaps, much reason to apprehend that any person would intentionally ride through these openings; but it is within the bounds of probability that any horse or horses having run away, and thus become unmanageable, might do so. It is not necessary to say what would be the consequence of such an event to any one who might be so unfortunate as to take a journey at full speed, either in a carriage or on horse, down such a declivity; or estimate the number of persons who might be killed or injured by being on the steps at the time. Perhaps to point out that such a calamity may be prevented, by railings placed on the curb-stone of the pavement opposite to the openings, which would not at all obstruct foot-passengers, for whom only those entrances are intended, is all that is now requisite.

In the "Monthly Repository," vol. vii. p. 226, there is a very good paper by ***Junius Redivivus***, on the State of the Working Classes; but it is singular enough that he here distinctly concedes the very point which he would not grant to R. of Bayswater, in the discussion which was carried on for some time in the pages of the Mech. Mag. between these parties. His words are:—"It is *clear* that the impediment of the physical condition of the poor must *precede* the improvement of their minds," &c.—A LOOKER-ON, *Bridgewater*, *Sept.* 13.

The only coal which has been yet found in India, available for steam-navigation, is the Burdwan coal; the power of which, compared with the best Newcastle, is as about 5 to 9. But although this coal is cheap in Calcutta, yet when shipped for the out-stations it becomes more expensive than sending out coal to them from England direct.

The railway system is making prodigious strides in the United States. There are already no less than thirty-seven railway companies in the State of New York alone—all incorporated since the opening of the Liverpool and Manchester Railway —whose united capitals amount to the sum of 29,865,000 dollars—nearly 6,000,000*l*. British.

A Sympathetic Ink, very far superior to any yet in use, may be thus made:—Dissolve a small quantity of starch in a saucer with soft water, and use the liquid like common ink; when dry no trace of the writing will appear upon the paper, and the letters can be developed only by a weak solution of iodine in alcohol, when they will appear of a purple colour, which will not be effaced until after long exposure to the atmosphere. So permanent are the traces left by the starch, that they cannot when dry be effaced by India-rubber.

Spontaneous Ignition of Coals.—Instances of this have, we understand, become of frequent occurrence since the alteration of the law, which substituted weight for measure in the sale of coals. When coals were sold by measure they used to be well screened, but now every thing is thrown in —even to the very dust—to make up weight. If the coal, therefore, has any sulphur in it, and the dust happens to get wet, spontaneous ignition is almost inevitable. When the hatches of a vessel, called the London, which was lately sent out to India with coal, were opened at Calcutta, a volume of flame instantly burst forth, and it was found necessary to half scuttle the vessel to extinguish the conflagration. It is supposed, that had the vessel continued at sea twenty-four hours longer she must with all on board have been destroyed. Something of the same kind occurred the other day to the coal ship at the dock-yard, Woolwich, from which the different Government steamers are supplied with coal. The hold was discovered to be in a kindling state, and they were obliged to turn the coal out of her, or she would have taken fire and sunk.

Street Names.—On some of the glass lamps in Paris the names of the streets are inscribed. It is desirable, says a Paris journal, that a similar inscription should be made upon every lamp at the corner of a street. This would prove useful at night, not only to strangers but to the Parisians themselves. The same thing in London would be of no small utility to both Londoners and strangers.

Preserving Bees in Winter.—Mr. Ethridge, of Mount Rose Pew, buried several hives of bees in the ground last year, sufficiently deep to be out of the reach of frost, and impervious to air, being first covered with straw and then mould. They were taken up in April, and the bees found to be in good health, and the honey not diminished.—***Blackwood's Journal of Agriculture.***

We shall be glad to hear again from Mr. White.

Communications received from Mr. Alderson—The Westminster Chess Club—Pit—Mr. W. Hegs —Mr. R. Smith.

The Supplement to the present Volume, with Preface, Titles, and Index, and Portrait, on Steel, of the late Mr. Telford, will be published on the 1st of November.

Erratum.

Page 405. For

$$\frac{O}{Y}=\frac{a\,R^{n-m}}{f}\left(\frac{g\,R^{m-1}}{b\,R^{n-1}}+\frac{h\,R^{m-2}}{c\,R^{n-3}}+\frac{i\,R^{m-3}}{d\,R^{n-3}}+\text{\&c.}\right)$$

It should have been,

$$\frac{O}{Y}=\frac{a\,R^{n-m}}{f}\left(\frac{g\,R^{m-1}+h\,R^{m-2}+i\,R^{n-3}}{b\,R^{n-1}+c\,R^{n-2}+d\,R^{n-3}}+\text{\&c.}\right)$$

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INDEX

TO THE TWENTY-FIRST VOLUME.

T.

411.